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29 September 2020

Ms. Raji Josiam
Remedial Project Manager
U.S. Environmental Protection Agency (EPA) Region 6
1201 Elm Street, Suite 500, SEDRA
Dallas, Texas 75270-2102

RE: Annual Technical Memorandum on the Soil Vapor Extraction System Operation and Maintenance July 2019 to July 2020, Revision 00
Jones Road Ground Water Plume Superfund Site
Remedial Action
EPA Region 6 Remedial Action Contract 2
Contract: EP-W-06-004
Task Order: 0129-RARA-06NK

Dear Ms. Josiam:

EA Engineering, Science, and Technology, Inc., PBC is submitting the Annual Technical Memorandum on the Soil Vapor Extraction System Operation and Maintenance July 2019 to July 2020, Revision 00 for the above-referenced Task Order on this day. The deliverable will be transmitted to the project SharePoint Site for download.

If you have any questions regarding this submittal, please call me at (972) 315-3922.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Patrick Appel'.

Patrick Appel, PMP
Project Manager

cc: William G. Johnson Jr., EPA Project Officer
Patrick Appel, EA Project Manager
Tim Startz, EA Program Manager (letter only via e-mail)
Diane Britt, TCEQ Remedial Project Manager
File



**Annual Technical Memorandum on the
Soil Vapor Extraction System Operation and
Maintenance
July 2019 to July 2020**

**Jones Road Ground Water Plume Superfund Site
Remedial Action
Houston, Harris County, Texas
EPA Identification No. TXN000605460**

**EPA Region 6 Remedial Action Contract 2
Contract No.: EP-W-06-004
Task Order No.: 0129-RARA-06NK**

Prepared for

U.S. Environmental Protection Agency
Region 6
1201 Elm Street, Suite 500
Dallas, Texas 75270-2102

Prepared by

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September 2020
Revision: 00
EA Project No. 14342.129

CONTENTS

	<u>Page</u>
LIST OF FIGURES	ii
LIST OF TABLES	iii
LIST OF APPENDIXES.....	iv
LIST OF ACRONYMS AND ABBREVIATIONS	v
1. INTRODUCTION	1
2. BACKGROUND	1
3. SOIL VAPOR EXTRACTION TREATMENT SYSTEM.....	2
3.1 SYSTEM COMPONENTS.....	2
3.2 NORMAL OPERATING AND MAINTENANCE PROCEDURES.....	2
3.3 REPAIRS AND ADJUSTMENTS	4
3.3.1 Shallow Moisture Separator Transfer Pump	4
3.3.2 Fine Bubble Aerator.....	4
3.3.3 Shallow System Vapor-Phase GAC Vessels	5
4. SYSTEM PERFORMANCE	5
4.1 SYSTEM READINGS.....	5
4.2 AIR SAMPLING RESULTS.....	6
4.3 PHOTOIONIZATION DETECTOR MEASUREMENTS	7
4.4 SVE WATER TREATMENT SYSTEM SAMPLING RESULTS	7
4.5 GROUNDWATER SAMPLING RESULTS	7
5. SUMMARY AND CONCLUSIONS	8
6. REFERENCES	10

LIST OF FIGURES

<u>Number</u>	<u>Title</u>
1	Soil Vapor Extraction Well Locations
2	Piping and Instrumentation Diagram of Soil Vapor Extraction System
3	Tetrachloroethene Results for Deep Soil Vapor Extraction Wells
4	Trichloroethene Results for Deep Soil Vapor Extraction Wells
5	Tetrachloroethene Results for Shallow Soil Vapor Extraction Wells
6	Trichloroethene Results for Shallow Soil Vapor Extraction Wells
7	PCE and TCE Concentrations, Deep SVE System Influent
8	Contaminant Mass Removal, Deep SVE System
9	PCE and TCE Concentrations, Shallow SVE System Influent
10	Contaminant Mass Removal, Shallow SVE System
11	Deep SVE System PID Readings, Total VOC
12	Shallow SVE System PID Readings, Total VOC
13	Water Treatment System Analytical Sampling Results
14	Concentration of PCE in Ground Water, Deep SVE Wells

LIST OF TABLES

<u>Number</u>	<u>Title</u>
1	SVE System Readings
2	Deep SVE System Analytical Sampling Results
3	Deep SVE System Analytical Sampling Results Summary
4	Deep SVE System Uptime and Mass Removal Summary
5	Deep SVE Well Analytical Sampling Results
6	Shallow SVE System Analytical Sampling Results
7	Shallow SVE System Analytical Sampling Summary
8	Shallow SVE System Uptime and Mass Removal Summary
9	Shallow SVE Well Analytical Sampling Results
10	Deep SVE System Photoionization Detector Readings
11	Shallow SVE System Photoionization Detector Readings
12	Water Treatment System Sampling Results
13	Summary of Water Treatment System Analytical Sampling
14	Summary of Ground Water Analytical Sampling

LIST OF APPENDIXES

<u>Appendix</u>	<u>Title</u>
A	System Readings Datasheets (Provided via CD)
B	Field Logbook (Provided via CD)
C	Air Sampling Analytical Reports (Provided via CD)
D	Water Sampling Analytical Reports (Provided via CD)

LIST OF ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
COC	Contaminant of concern
DCE	Dichloroethene
EA	EA Engineering, Science, and Technology, Inc., PBC
EPA	U.S. Environmental Protection Agency
ft.	Foot (feet)
GAC	Granular activated carbon
in. wc	Inches of water column
in. Hg	Inches of mercury
lb	Pound(s)
MCL	Maximum contaminant level
µg/L	Microgram(s) per liter
µg/m ³	Microgram(s) per cubic meter
O&M	Operation and maintenance
%	Percent
PCE	Tetrachloroethene
PID	Photoionization detector
PLC	Programmable logic controller
scfm	Standard cubic feet per minute
site	Jones Road Groundwater Plume Superfund Site
SVE	Soil vapor extraction
TCE	Trichloroethene
VC	Vinyl chloride
VOC	Volatile organic compound

1. INTRODUCTION

EA Engineering Science and Technology, Inc., PBC (EA) has prepared the Annual Technical Memorandum on the Soil Vapor Extraction (SVE) System Operation and Maintenance (O&M), July 2019 to July 2020 for Task Order No. 0126-RARA-06NK under U.S. Environmental Protection Agency (EPA) Response Action Contract EP-W-06-004.

This memorandum covers the period of 30 July 2019 through 31 July 2020. EA has operated and maintained the SVE system at the Jones Road Ground Water Plume Superfund Site (site) since the system startup on 24 July 2019. This memorandum discusses the O&M activities, sampling results, and performance of the SVE treatment system.

2. BACKGROUND

The site is located in the northwest portion of Houston, Harris County, Texas at 11600 Jones Road. The contaminants of concern (COCs) include tetrachloroethene (PCE) and related daughter products trichloroethene (TCE), cis-1,2-dichloroethene (DCE), trans-1,2-DCE, and vinyl chloride (VC), which are present in the subsurface aquifers and vadose zones.

The most significant aquifers at the site are the Evangeline Aquifer and the Chicot Aquifer. The Chicot Aquifer is estimated to extend to a depth of approximately 400 feet (ft) below ground surface (bgs). The first water-bearing unit exists from approximately 20 to 35 ft bgs, where soils consist of interbedded sand, silt, and silty clay. The Shallow SVE System (SS) is intended to treat Shallow Source Area Soil, which exists in the unsaturated zone above 20 ft bgs where soils consist of high-plasticity clay.

The second water-bearing unit is present at a depth of approximately 110 ft bgs and is considered to be the first major water-bearing unit of the Chicot Aquifer. A well-developed sand zone exists from approximately 60 to 110 ft bgs, a clay zone with minor sand lenses that exists from approximately 110 to 150 ft bgs, a sand unit underlies the clay and extends from approximately 150 to 190 ft bgs. The Deep SVE System is intended to target the Deep Unsaturated Chicot Sand, which exists from 60 to 110 ft bgs. Stratigraphy across the site is known to be highly variable.

3. SOIL VAPOR EXTRACTION TREATMENT SYSTEM

This section describes SVE system components, SVE system O&M, and system repairs and adjustments.

3.1 SYSTEM COMPONENTS

Two SVE systems (deep and shallow) are present at the site to address contamination in different subsurface zones. Each SVE system consists of SVE wells, a conveyance piping network and influent manifold, a moisture separator, SVE pumps, and vapor-phase granular activated carbon (GAC) treatment vessels. The deep SVE is driven by a Rotron blower and the shallow SVE system is driven by a Travaini liquid ring pump. Detailed descriptions of the SVE system components are available in the Soil Vapor Extraction System Operation and Maintenance Manual (EA 2020). The SVE wells are positioned across the site as shown in Figure 1.

Water captured by either moisture separator is transferred into the water treatment system, which consists of two transfer pumps that move water out of the moisture separators, two bag filters, one Organoclay treatment vessel, two liquid-phase GAC treatment vessels, a 2,000-gallon storage tank, a transfer pump to move water out of the storage tank, and two subsurface injection wells for disposal of treated water. A fine bubble aerator was retrofitted in the storage tank to provide additional water treatment capacity, as described in Section 3.3.2.

A piping and instrumentation diagram of the SVE system is provided in Figure 2. The pumps and other components of the system are able to be monitored and controlled via a central programmable logic controller (PLC) located at the site.

3.2 NORMAL OPERATING AND MAINTENANCE PROCEDURES

The SVE system has been operating since July 2019. Scheduled O&M visits include the following activities, including sampling, as outlined in the SVE System Operation and Maintenance Manual:

Weekly

- Record the pressure or vacuum readings at the following locations:
 - (2) SVE pump influent (manifold header), Deep and Shallow
 - (2) SVE pump effluent, Deep and Shallow
 - (2) 1st GAC influent, Deep and Shallow
 - (2) 1st GAC effluent / 2nd GAC influent, Deep and Shallow
 - (2) 2nd GAC effluent (pre-atmospheric discharge), Deep and Shallow.
- Record photoionization detector (PID) readings at the following locations:
 - (10) Piping manifold well legs (raw well air), Deep

- (11) Piping manifold well legs (raw well air), Shallow
 - (2) 1st GAC influent (pre-treatment), Deep and Shallow
 - (2) 1st GAC effluent (mid-treatment), Deep and Shallow
 - (2) 2nd GAC effluent (post-treatment), Deep and Shallow.
- (21) Record the rotameter reading on each leg of the SVE manifold, Deep and Shallow.
- Check manifold legs on the shallow SVE system for excessive water intake.
- (2) Record the system total flow rate from the PLC, Deep and Shallow.
- (2) Record the SVE pump effluent temperature, Deep and Shallow.
- Record fluid level in the storage tank.
- Check the level and top off, if necessary: sealant oil in the liquid ring pump (shallow SVE system).
- Replace bag filters.
- Inspect the air lines and fittings supplying the water storage tank aerator.
- Inspect the air compressor for excessive noise or vibration.
- Inspect for water in the air compressor tank and check operation of the automatic tank drain device.
- Open or close the control valves for the storage tank discharge, based on current seasonal water inflow rate to the system and current tank level.
- Audibly inspect SVE and water transfer pumps for excessive noise or vibration during operation.
- Visually inspect treatment vessels (vapor and liquid), valves, and adjacent piping for leaks.
- Visually inspect piping manifolds for damage or air leaks.
- Visually inspect all system components.

Monthly

- Perform all weekly O&M tasks

- Collect vacuum readings at each SVE wellhead
- Collect the vapor samples listed below and submit them for laboratory analysis:
 - (2) 1st GAC influent (pre-treatment), Deep and Shallow
 - (2) 1st GAC effluent (mid-treatment), Deep and Shallow
 - (2) 2nd GAC effluent (post treatment), Deep and Shallow.
- Perform pump-specific O&M tasks, such as applying grease at manufacturer-specified intervals.
- Check exhaust fans and vent louvers.
- Inspect perimeter fence and entry gates for damage or security concerns.
- Download system performance logs from the remote access website:
 - Component run time data
 - Analog data
 - Flow meter totalizer data
 - Discrete data.

3.3 REPAIRS AND ADJUSTMENTS

Repairs and adjustment made to the shallow SVE system during the operational period are described here.

3.3.1 Shallow Moisture Separator Transfer Pump

The moisture separator transfer pump was damaged due to the fine sediment entrained in the separated water. Repair of the pump included replacing some pump components and was carried out by the pump manufacturer's local authorized service company. To prevent additional damage caused by the sediment, a gearbox was retrofitted to the pump to reduce the rotational speed of the pump by a 5:1 ratio. During the repair, sediment was discovered in the downstream piping and water storage tank. The liquid-phase GAC and Organoclay were changed out on 12 November 2019, at which time sediment was discovered within the Organoclay and GAC vessels. From startup, the bag filter housings had been fitted with 5-micron filter bags, which proved ineffective in capturing a significant portion of the sediment entrained in the water. Beginning November 2019, 1-micron filter bags were used but they still did not capture a significant portion of the sediment before passing through the rest of the water treatment system.

3.3.2 Fine Bubble Aerator

EA stopped discharging treated water effluent to the injection wells when effluent water samples showed elevated levels of PCE during startup testing on 30 July and 1 August 2020. The criteria for disposal via subsurface injection during the system design was considered to be the EPA's Maximum Contaminant Level for PCE in drinking water, which is 5 micrograms per liter (µg/L).

The elevated effluent concentration was caused by higher than anticipated influent concentration and insufficient treatment of the water by the system. Additional treatment was accomplished via recirculation of the water from the storage tank through the GAC vessels and aeration of the water via a sump pump within the storage tank, which was effective in bringing the PCE concentration below the MCL. Subsequently, sampling was done prior to discharge of treated water from the storage tank to confirm PCE concentration was below the MCL.

On 25 February 2020, the sump pump was replaced with a fine bubble aerator to improve the water treatment capacity of the system. The air compressor within the system enclosure was connected to provide a constant stream of air to the aerator. Since the aerator was installed, every storage tank water sample has shown PCE concentrations below the MCL, even though samples from the GAC effluent shows the GAC continues to be ineffective.

3.3.3 Shallow System Vapor-Phase GAC Vessels

Water accumulated in the shallow SVE system vapor-phase GAC vessels, causing a pressure relief valve to be tripped and discharge untreated influent directly to the atmosphere. The water typically was gravity drained during temporary system shutdowns, and put back into the moisture separator to be processed through the water treatment system. On 10 June 2020, GAC particles were observed in the water draining from the vessels. EA subcontractor TetraSolv inspected the vessels on 10 July 2020 and observed damage to the screen that holds the GAC in place. The screen was replaced with a new one and the shallow SVE system was able to be restarted immediately.

The deep SVE system did not require any repairs or adjustments that required downtime.

4. SYSTEM PERFORMANCE

4.1 SYSTEM READINGS

The deep and shallow SVE systems are designed to run continuously (24 hours a day, 7 days a week). The systems were temporarily shut down to conduct O&M, repairs, GAC change outs, site wide ground water and indoor air sampling, and optimization. Weekly routine O&M activities do not require system shutdown. System readings presented in Table 1 and summarized below are for the period from 30 July 2019 to 31 July 2020.

The blower for the deep SVE system operated for 7,980 hours (approximately 90% uptime). The total system flow rate ranged between 227 and 336 standard cubic feet per minute (scfm) and averaged approximately 294 scfm. Vacuum at the pump influent ranged between 32.7 and 66.8 inches of water column (in. WC) and averaged 47.8 in. WC. The blower effluent temperature ranged between 101 and 170 degrees Fahrenheit (°F) and averaged approximately 144 °F.

The liquid ring pump for the shallow SVE system operated for 6,640 hours (approximately 75% uptime). The total system flow rate ranged between 15.8 and 55.4 scfm and averaged approximately 35.9 scfm. Vacuum at the pump influent ranged between 23.1 and 26.7 inches of mercury (in. Hg) and averaged 24.6 in. Hg. The pump effluent temperature ranged between 98 and 133 degrees Fahrenheit (°F) and averaged approximately 117 °F. The shallow SVE system generated 26,465 gallons of water in the moisture separator, which were processed through the water treatment system.

Field documentation, field datasheets, and field logbooks are provided in Appendix A and Appendix B.

4.2 AIR SAMPLING RESULTS

The July 2019 sampling was performed during the system startup period. Other sampling events have occurred during normal system operations. No sampling has occurred after significant periods of system shutdowns.

Deep SVE System

Air samples for the treatment system were collected in Tedlar bags from sampling ports located on the treatment vessels. The deep system samples are collected before, between, and after the two GAC treatment vessels. Table 2 provides a complete listing of sample results for six COCs from the deep SVE system. A summary of PCE and TCE results is provided in Table 3. The influent sample results for the deep SVE system are shown in Figure 7.

As of 31 July 2020, approximately 3,830,000 cubic meters (135,000,000 cubic feet) of air have been extracted by the deep SVE system (Table 4). This volume represents approximately 120 pore volumes. The target pore volume flushing to achieve remediation during the design stage was estimated at 500 pore volumes. However, this was an estimate and actual soil vapor concentrations and mass removal rates should be utilized to determine achieving the remedial objectives. The monthly and cumulative mass removal trends for the deep SVE system are provided in Figure 8.

Air samples for the deep SVE wells were collected in Tedlar bags from sample ports on the influent piping manifold. A diaphragm sampling pump was used to draw air into the bags because the sample ports are under a vacuum while the system is running. The analytical reports for sampling activities are provided in Appendix C. The wellhead sample results for the deep SVE wells are provided in Table 5 and shown in Figure 3 and Figure 4

Shallow SVE System

Air samples for the treatment system were collected in Tedlar bags from sampling ports located on the treatment vessels. The shallow system samples are collected before, between, and after the two GAC treatment vessels. Table 6 provides a complete listing of sample results for six

COCs from the shallow SVE system. A summary of PCE and TCE results is provided in Table 7. The influent sample results for the deep SVE system are shown in Figure 9.

374,000 cubic meters (13,200,000 cubic feet) of air have been extracted by the shallow SVE system (Table 8). This volume represents approximately 390 pore volumes. The target pore volume flushing to achieve remediation during the design stage was estimated at 500 pore volumes. However, this was an estimate and actual soil vapor concentrations and mass removal rates should be utilized to determine the achieving remedial objectives. The monthly and cumulative mass removal trends for the deep SVE system are provided in Figure 10.

Air samples for the shallow SVE wells were collected in Tedlar bags from sample ports on the influent piping manifold. A diaphragm sampling pump was used to draw air into the bags because the sample ports are under a vacuum while the system is running. The analytical reports for sampling activities are provided in Appendix C. The wellhead sample results for the shallow SVE wells are provided in Table 9 and shown in Figure 5 and Figure 6.

4.3 PHOTOIONIZATION DETECTOR MEASUREMENTS

PID readings were collected starting 12 May 2020 from the SVE treatment system and from the manifold for each SVE well. The deep SVE system PID readings are presented in Table 10 and Figure 11. The shallow SVE system PID readings are presented in Table 11 and Figure 12.

4.4 SVE WATER TREATMENT SYSTEM SAMPLING RESULTS

Water samples were collected in volatile organic analysis sample containers from sampling ports located before, between, and after the two GAC treatment vessels and from within the water storage tank. The influent sample is drawn from a sample port before the Organoclay treatment vessel. Water system sampling typically occurs on an as-needed basis during periods of high water capture by the SVE system. During this period, higher water capture occurred during the summer, fall, and spring, with lower water capture during the winter months. Table 12 provides a complete listing of sample results for six COCs from the water treatment system. A summary of PCE and TCE results is provided in Table 13. Sampling trends for the water treatment system are provided in Figure 13.

4.5 GROUNDWATER SAMPLING RESULTS

Groundwater samples were collected using a low-flow procedure from deep and shallow wells during site-wide sampling events in June 2019 (prior to SVE system startup), February 2020, and June 2020. Samples were analyzed for volatile organic compounds (VOC)s by EPA Method 8260B. A summary of the PCE concentrations from the samples are provided in Table 14.

5. SUMMARY AND CONCLUSIONS

During this operation period, the following trends were noted:

- PCE and TCE concentrations at the deep SVE system influent (Pre-GAC) have continuously trended down (Table 3, Figure 7). When comparing startup sampling in July 2019 and the most recent sampling in July 2020, concentrations of all COCs have decreased.
- PCE and TCE mass removal rates from the deep SVE system trended down due primarily to decreasing influent concentrations (Table 4, Figure 8). The monthly PCE and TCE removal rates during August 2019 were 0.06807 pounds per hour (lb./hr.) and 0.00235 lb./hr., respectively. The monthly PCE and TCE removal rates during July 2020 were 0.00001 lb./hr. and 0.00000 lb./hr., respectively.
- PCE and TCE concentrations in every deep SVE well decreased between July 2019 and January 2020 with one exception (Table 5). TCE increased in SVE-2 from 2,500 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) to 2,800 $\mu\text{g}/\text{m}^3$. The lowest decrease was observed in SVE-1, which saw a 13% decrease in concentration of PCE and 14% decrease in concentration of TCE. The highest decrease was observed in SVE-4, which had 99% decrease in PCE and TCE concentrations.
- During the reporting period, 68,429 grams (151 pounds) of PCE and 1,945 grams (4.3 pounds) of TCE were extracted from the deep SVE system (Table 4).
- PCE and TCE concentrations at the shallow SVE system influent (Pre-GAC) trended down between October 2019 and April 2020 but trended up between April and July 2020 (Table 6, Figure 9). When comparing startup sampling in July 2019 and the most recent sampling in July 2020, concentrations of all COCs have decreased.
- PCE and TCE mass removal rates from the shallow SVE system trended down between October 2019 and April 2020 but trended up between April and July 2020 (Table 8). This occurred despite lower overall air flow rates in May, June, and July of 2020.
- Between July 2019 and January 2020 concentrations of PCE and TCE fluctuated in every shallow SVE well. Four wells exhibited increased PCE concentrations and seven wells showed decreasing PCE concentrations. Three wells had increased TCE concentrations and eight wells had decreased TCE concentrations.
- During the current period, 62,255 grams (137 pounds) of PCE and 2,956 grams (6.5 pounds) of TCE were extracted from the shallow SVE system (Table 8).
- During the drier winter months, water influent flow rate was significantly decreased, allowing for more consistent uptime of the shallow SVE system and continual decrease in PCE and TCE influent concentrations and mass removal (Table 1, Table 8, Figure 9).

Wetter spring weather resulted in more water capture and more system shutdowns due to high water levels and high pump temperature.

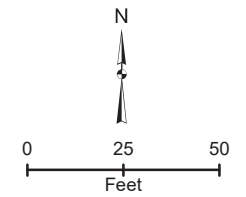
- Concentrations of PCE and TCE in the water system influent samples have trended downwards (Table 13, Figure 13).
- In every sampled case, water treatment in the GAC vessels was insufficient in bringing effluent below the MCL for PCE in drinking water, which is 5 µg/L (Table 13). Additional treatment was achieved by mixing water within the storage tank or introducing the fine bubble aerator prior to discharging water via subsurface reinjection.
- PCE was non-detectable in ground water collected from eight of 11 shallow wells sampled in February and June 2020 (Table 14). Only one well exceeded the MCL for PCE in June 2020, which was MW-20 located near the center of the parking lot at the site.
- PCE concentration in ground water collected from deep SVE wells decreased from June 2019 to June 2020 (Table 14). The maximum observed decrease in PCE concentration was 91% at SVE-2. The minimum observed decrease in PCE concentration was 12% at SVE-8. During the June 2020 sampling event, none of the deep SVE wells had concentrations below the MCL for PCE.

6. REFERENCES

EA Engineering, Science, and Technology, Inc., PCB (EA). 2020. Soil Vapor Extraction System Operation and Maintenance Manual, Jones Road Ground Water Plume Superfund Site, Revision 00. August.

FIGURES

2020-04-22 M:\Federal\EPARAC II\0070-Jones Road RD\GIS\MXDs\RA\Fig\SSVE.mxd EA-Dallas jschwertz



- ◆ Shallow Soil Vapor Extraction Well
- ◆ Deep Soil Vapor Extraction Well
- ▬ 11600 Jones Road

Note:
SVE-08 was installed during the Remedial Investigation for the site. It is not currently connected to the Deep SVE System.

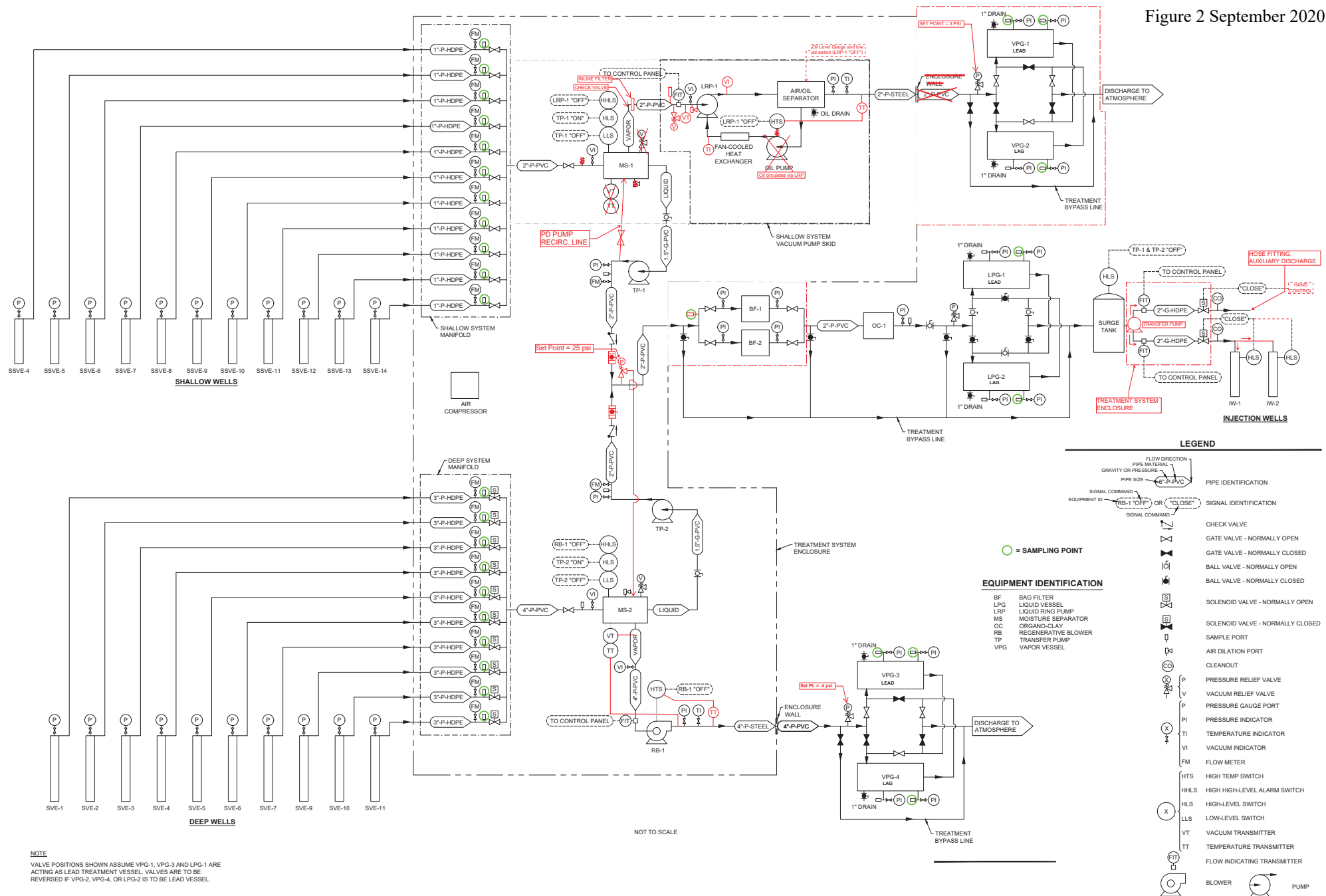
Image Source: GoogleEarth Pro, 2020



Remedial Action
Jones Road Ground Water Plume
Houston, Harris County, Texas

Annual Technical Memorandum on the Soil Vapor Extraction System
Operation and Maintenance, July 2019 to July 2020
Figure 1
Soil Vapor Extraction Well Locations

Piping and Instrumentation Diagram of Soil Vapor Extraction System



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- ◆ Deep Soil Vapor Extraction Well
- ▭ 11600 Jones Road

Notes:

Sampling Dates:
July 30, 2019 (top)
January 14, 2020 (bottom)

All results in µg/m³ (micrograms per cubic meter)

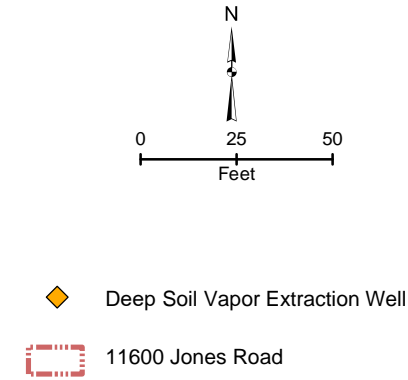
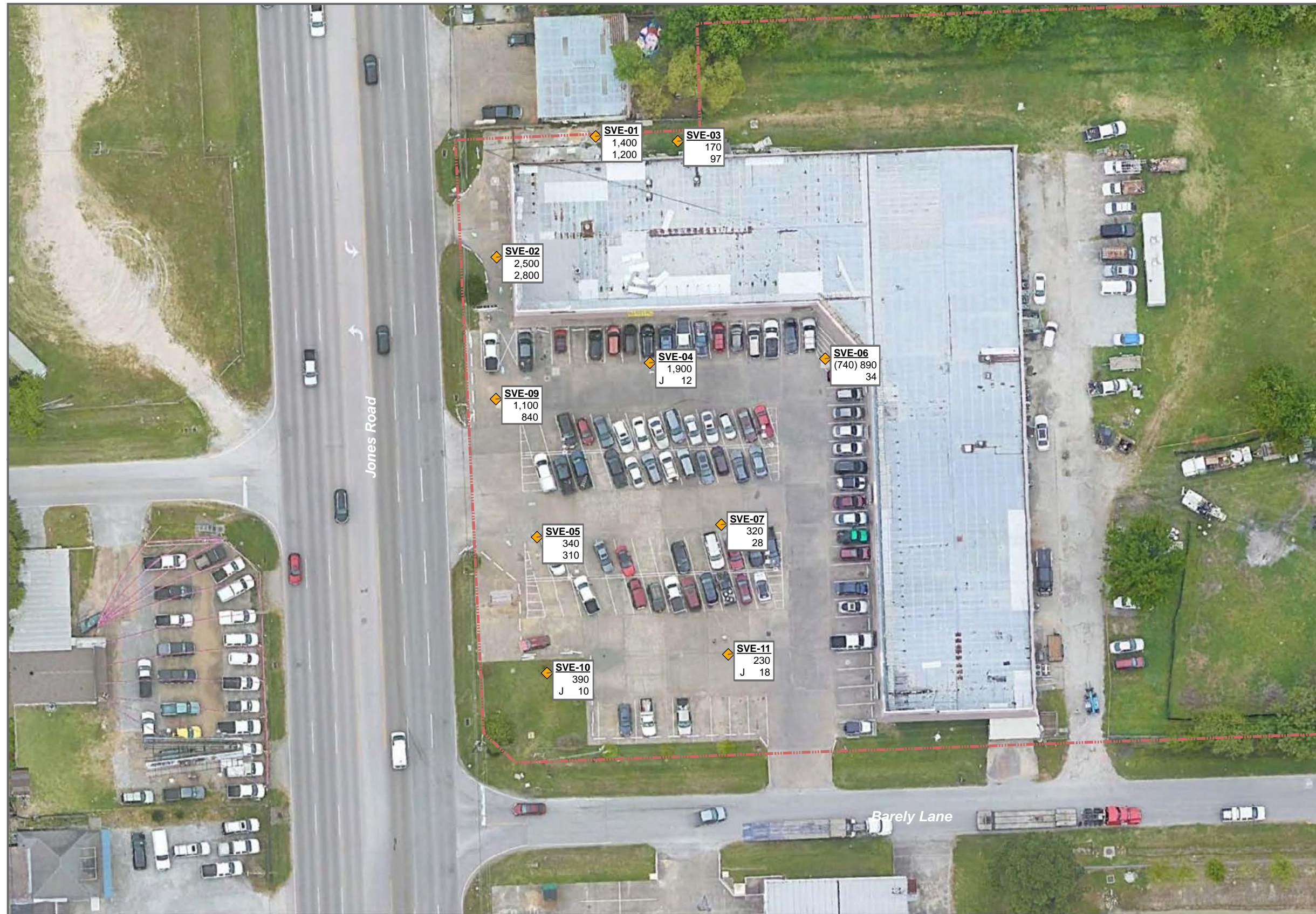
Duplicate sample results are in parentheses

Image Source: GoogleEarth Pro, 2020



Remedial Action
Jones Road Ground Water Plume
Houston, Harris County, Texas

Annual Technical Memorandum on the Soil Vapor Extraction System
Operation and Maintenance, July 2019 to July 2020
Figure 3
Tetrachloroethene Results for Deep Soil Vapor Extraction Wells



Notes:

Sampling Dates:
July 30, 2019 (top)
January 14, 2020 (bottom)

All results in $\mu\text{g}/\text{m}^3$ (micrograms per cubic meter)

Duplicate sample results are in parentheses

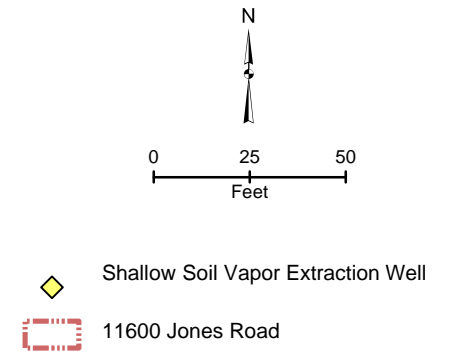
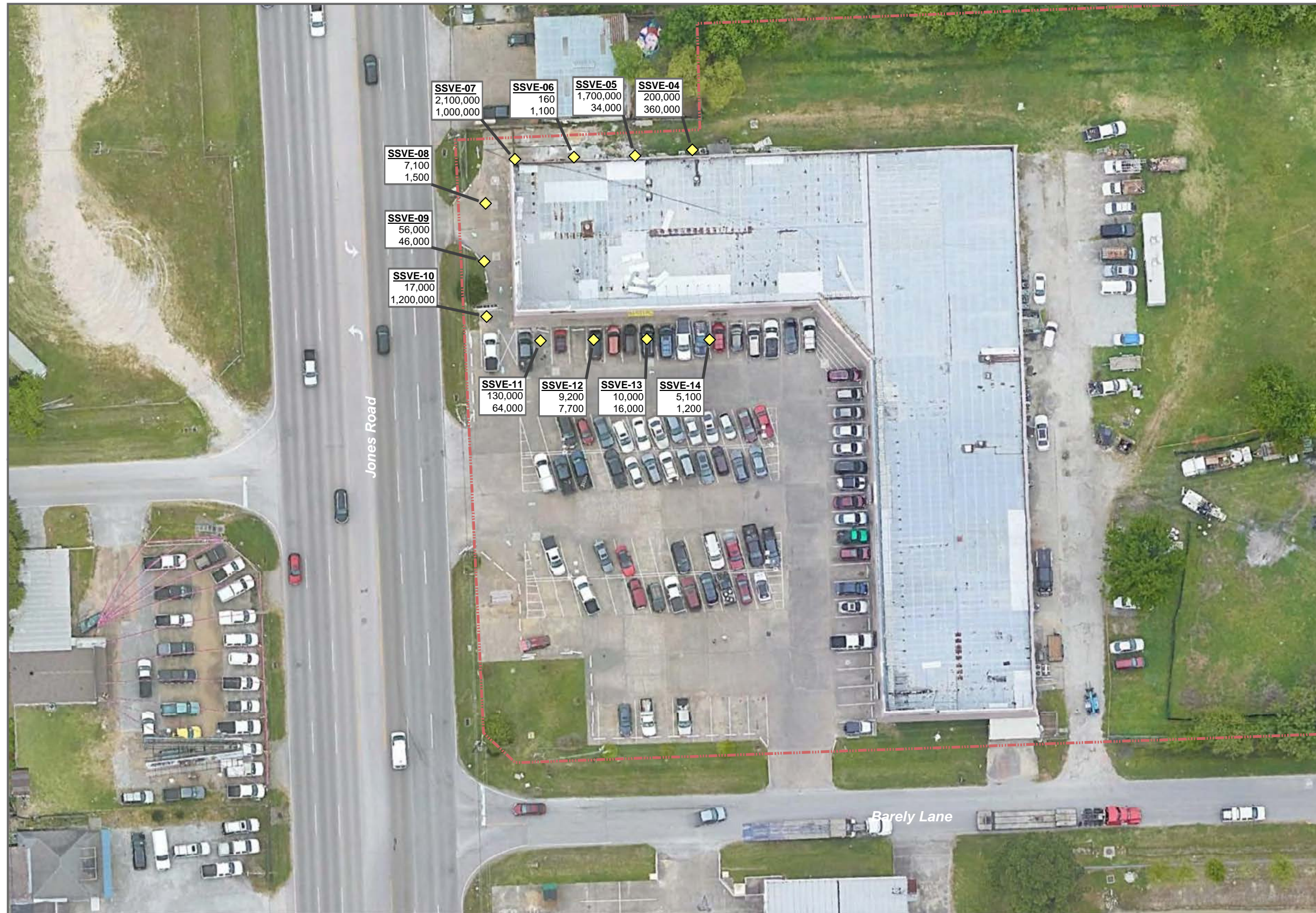
"J" indicates the result is above the method detection limit, below the reporting limit, and is estimated.

Image Source: GoogleEarth Pro, 2020



Remedial Action
Jones Road Ground Water Plume
Houston, Harris County, Texas

Annual Technical Memorandum on the Soil Vapor Extraction System
Operation and Maintenance, July 2019 to July 2020
Figure 4
Trichloroethene Results for Deep Soil Vapor Extraction Wells



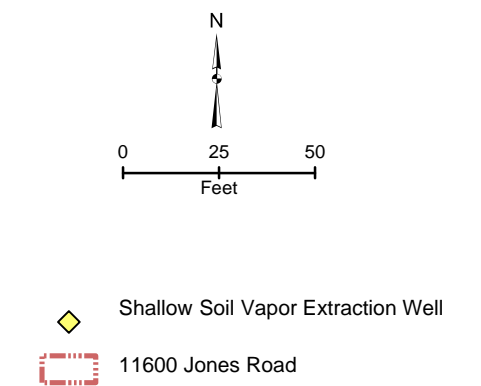
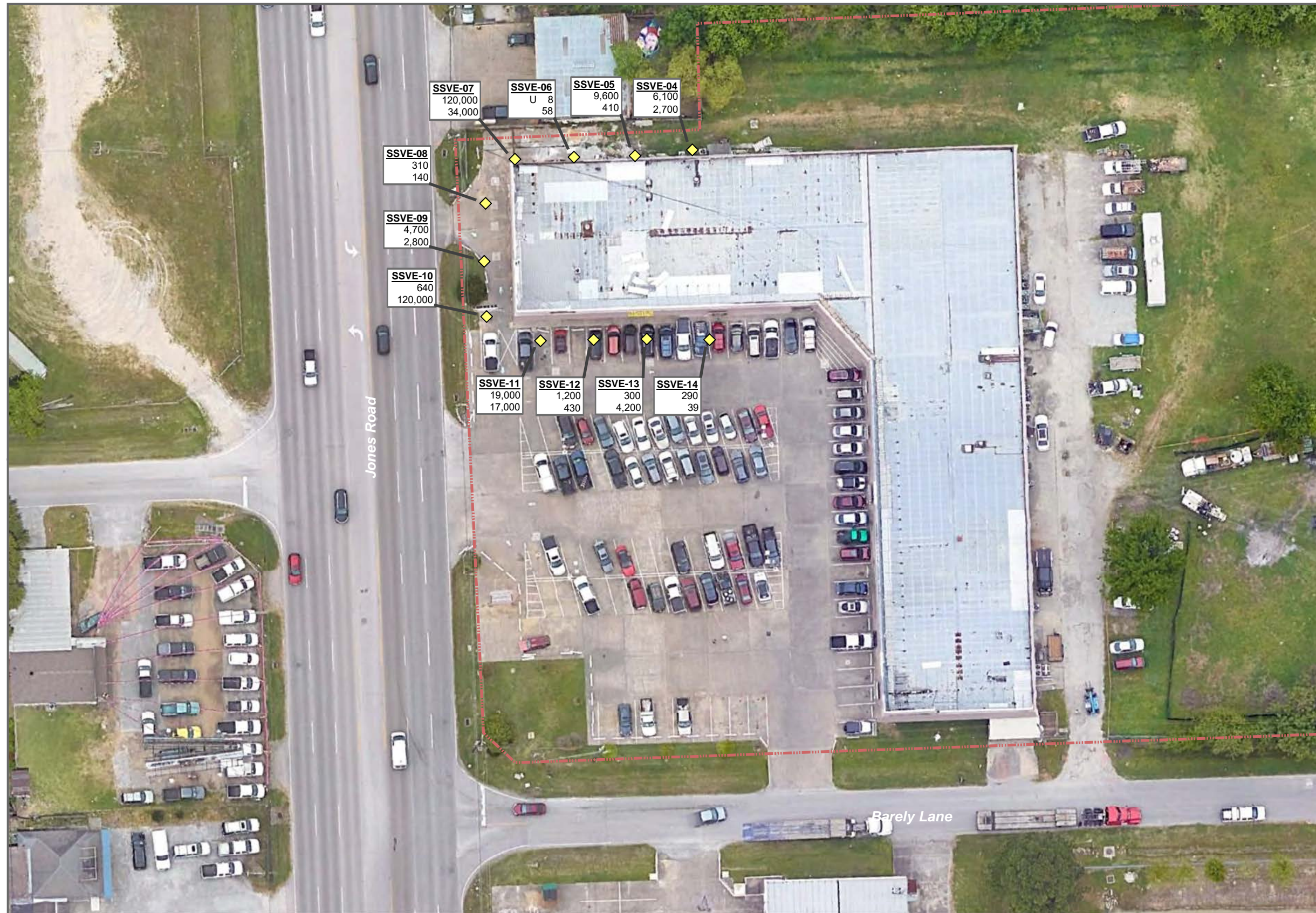
Notes:
Sampling Dates:
July 30, 2019 (top)
January 14, 2020 (bottom)
All results in $\mu\text{g}/\text{m}^3$ (micrograms per cubic meter)

Image Source: GoogleEarth Pro, 2020



Remedial Action
Jones Road Ground Water Plume
Houston, Harris County, Texas

Annual Technical Memorandum on the Soil Vapor Extraction System
Operation and Maintenance, July 2019 to July 2020
Figure 5
Tetrachloroethene Results for Shallow Soil Vapor Extraction Wells



Notes:

Sampling Dates:
July 30, 2019 (top)
January 14, 2020 (bottom)

All results in $\mu\text{g}/\text{m}^3$ (micrograms per cubic meter)

"U" indicates the result was below the
method detection limit

Image Source: GoogleEarth Pro, 2020



Remedial Action
Jones Road Ground Water Plume
Houston, Harris County, Texas

Annual Technical Memorandum on the Soil Vapor Extraction System
Operation and Maintenance, July 2019 to July 2020
Figure 6
Trichloroethene Results for Shallow Soil Vapor Extraction Wells

Figure 7
PCE and TCE Concentrations, Deep SVE System Influent

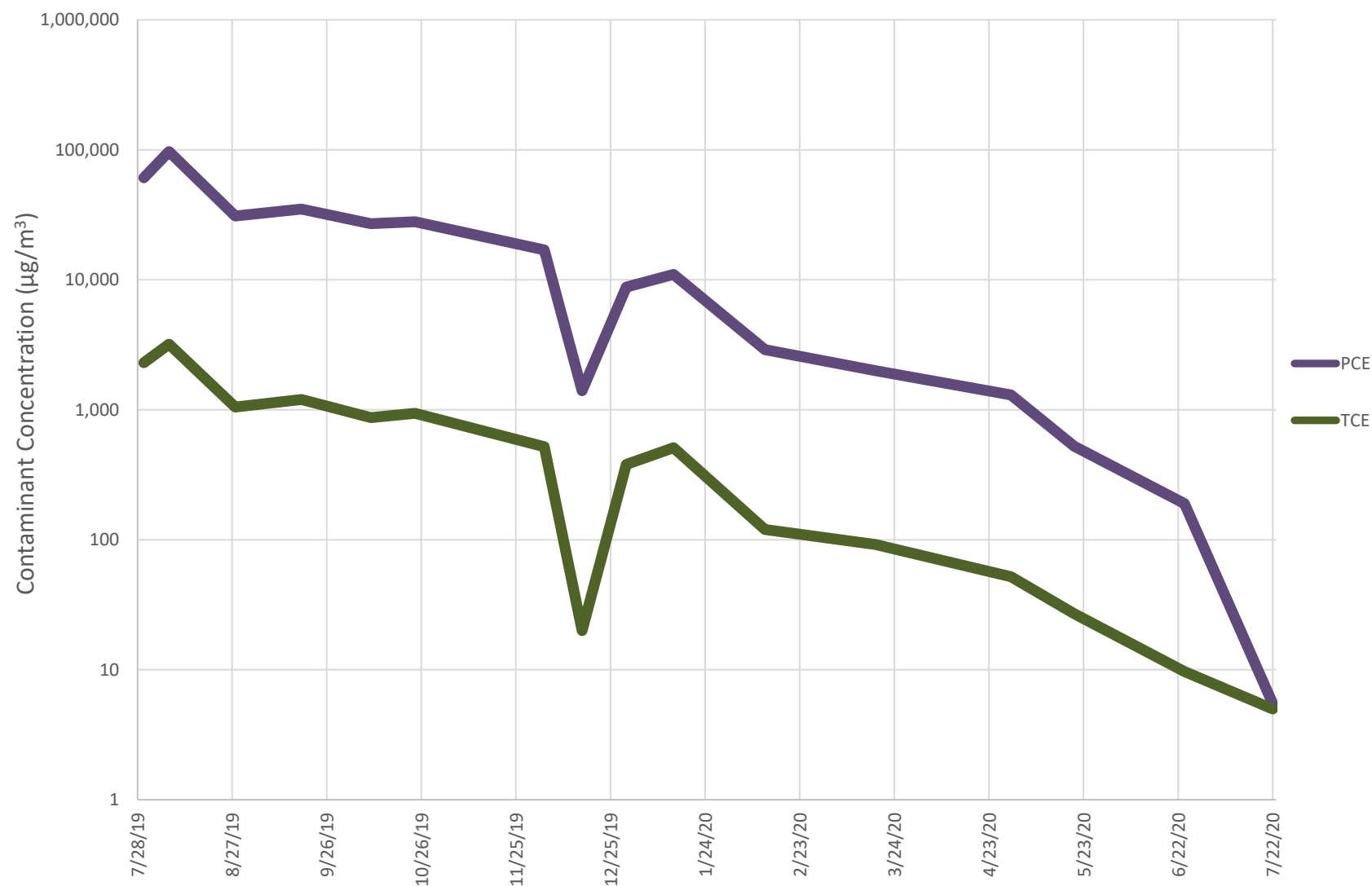


Figure 8
Contaminant Mass Removal, Deep SVE System

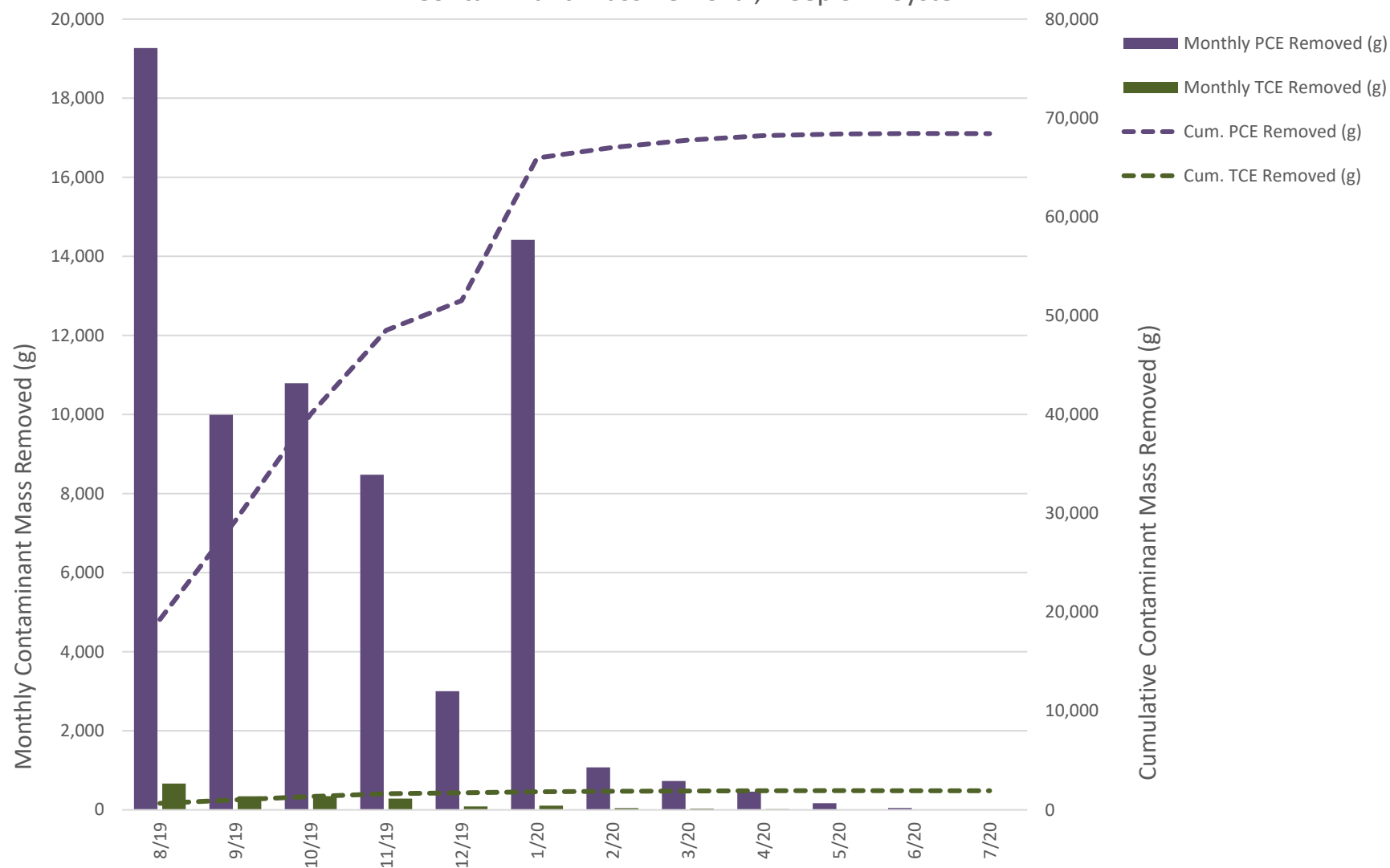
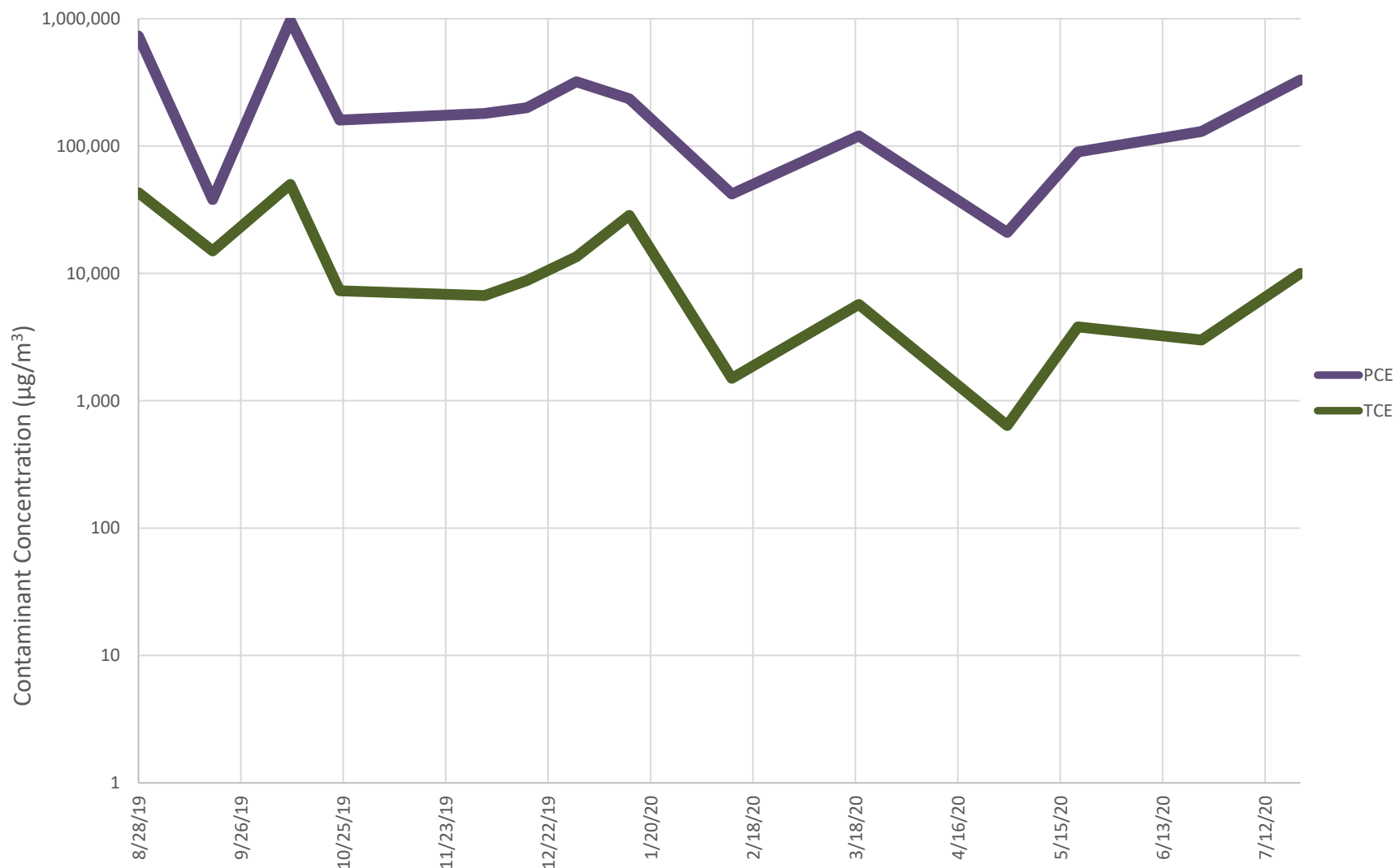


Figure 9
PCE and TCE Concentrations, Shallow SVE System Influent



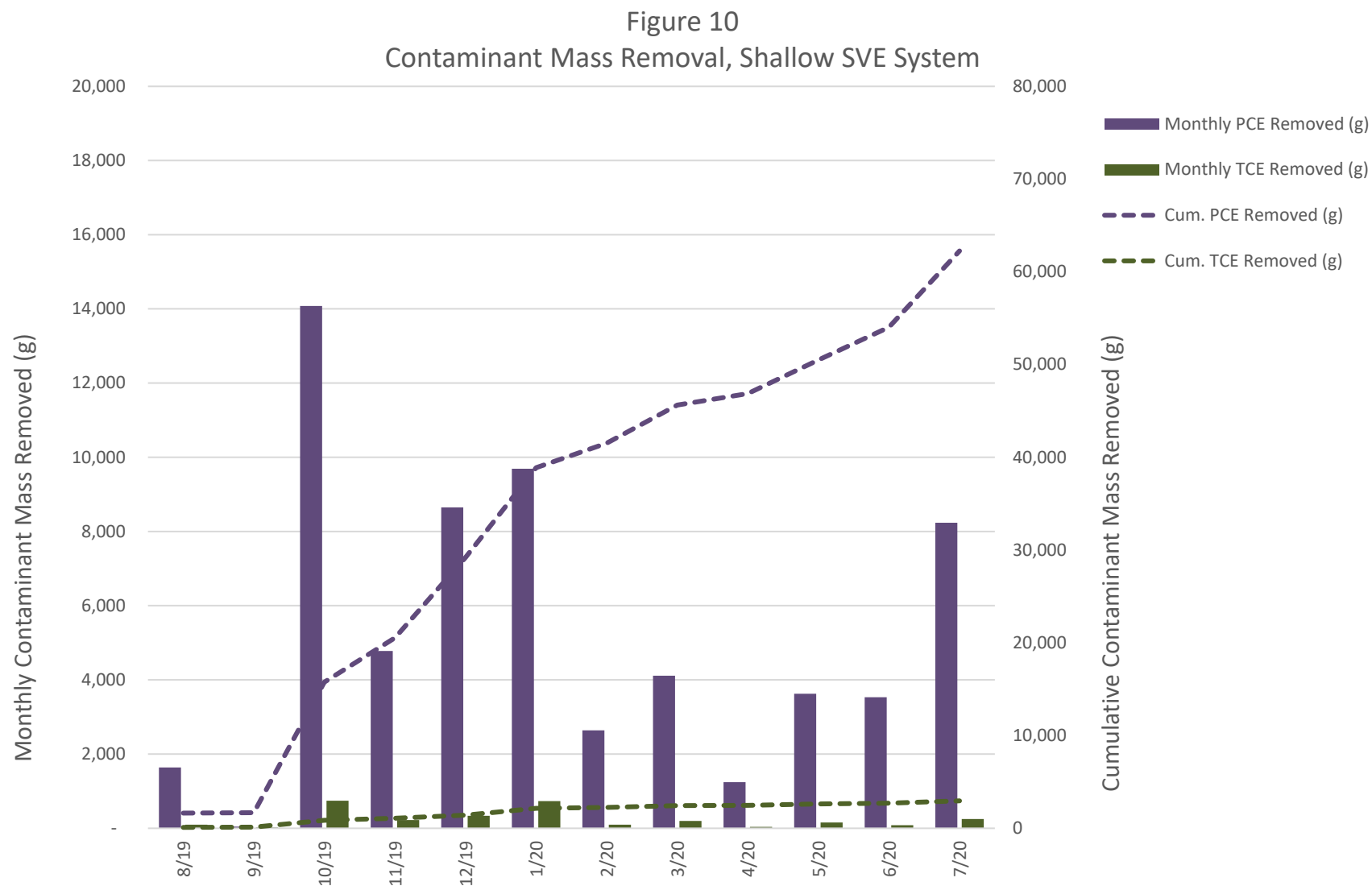


Figure 11
Deep SVE System PID Readings, Total VOC

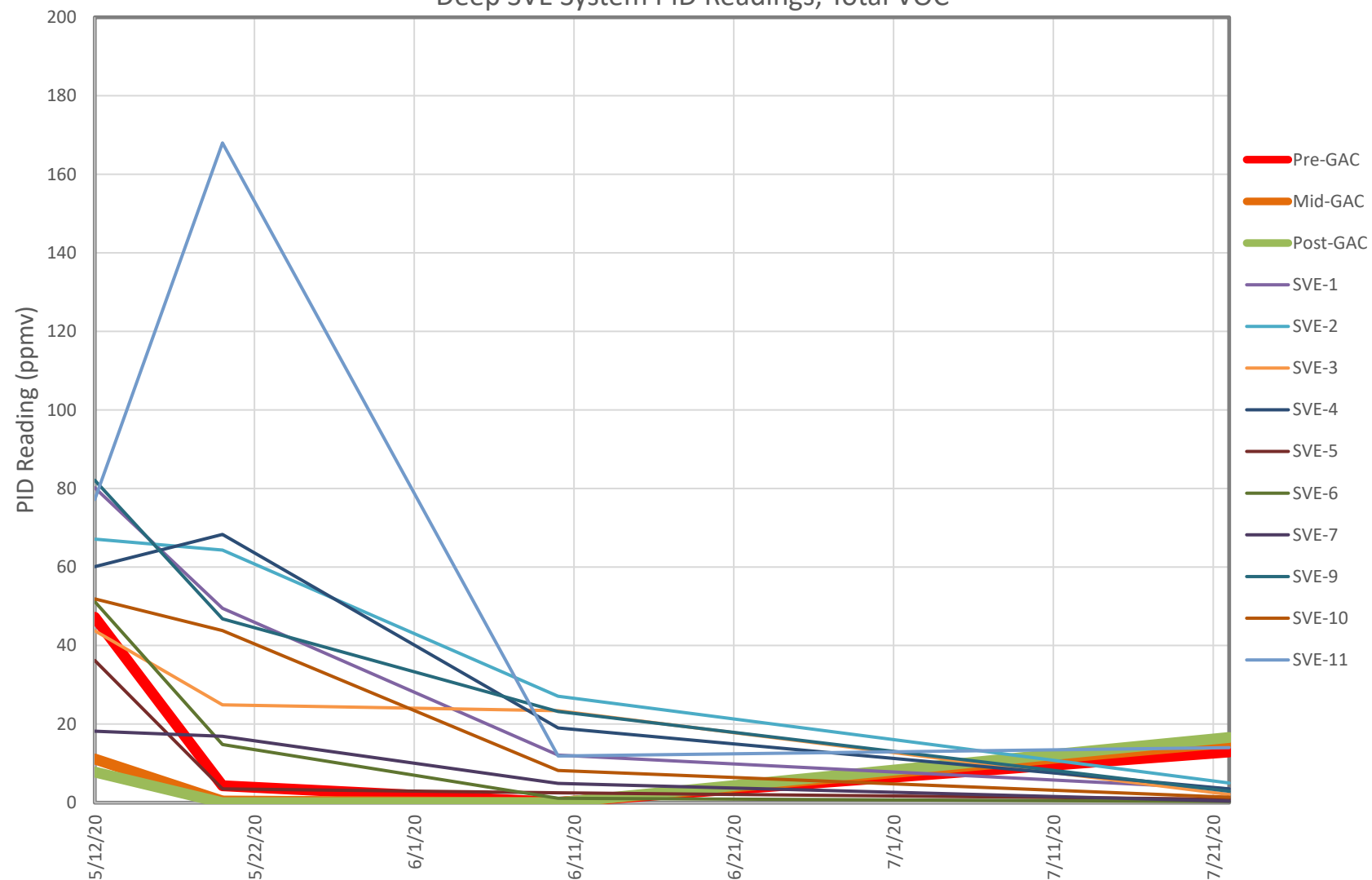


Figure 12
Shallow SVE System PID Readings, Total VOC

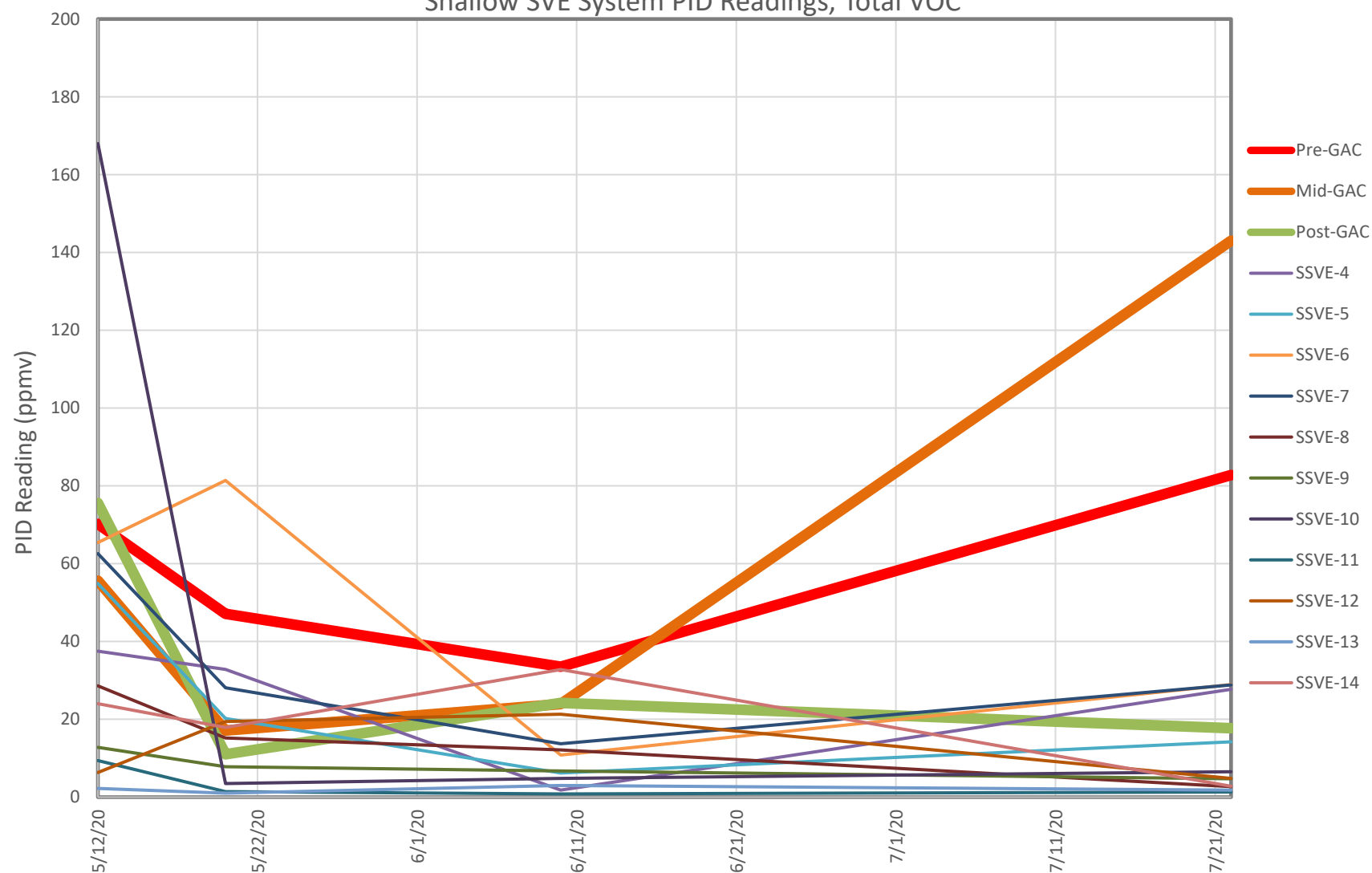
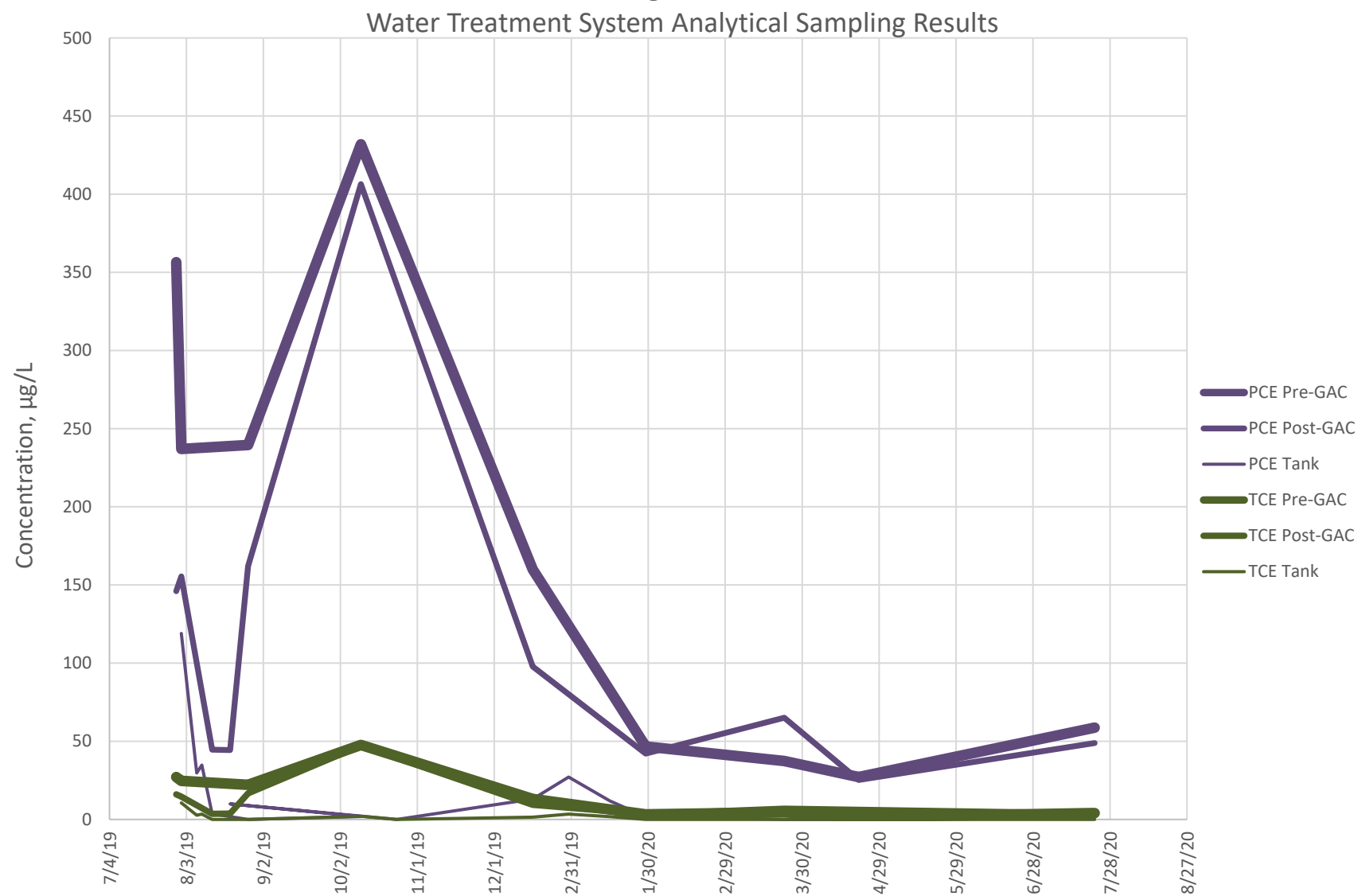
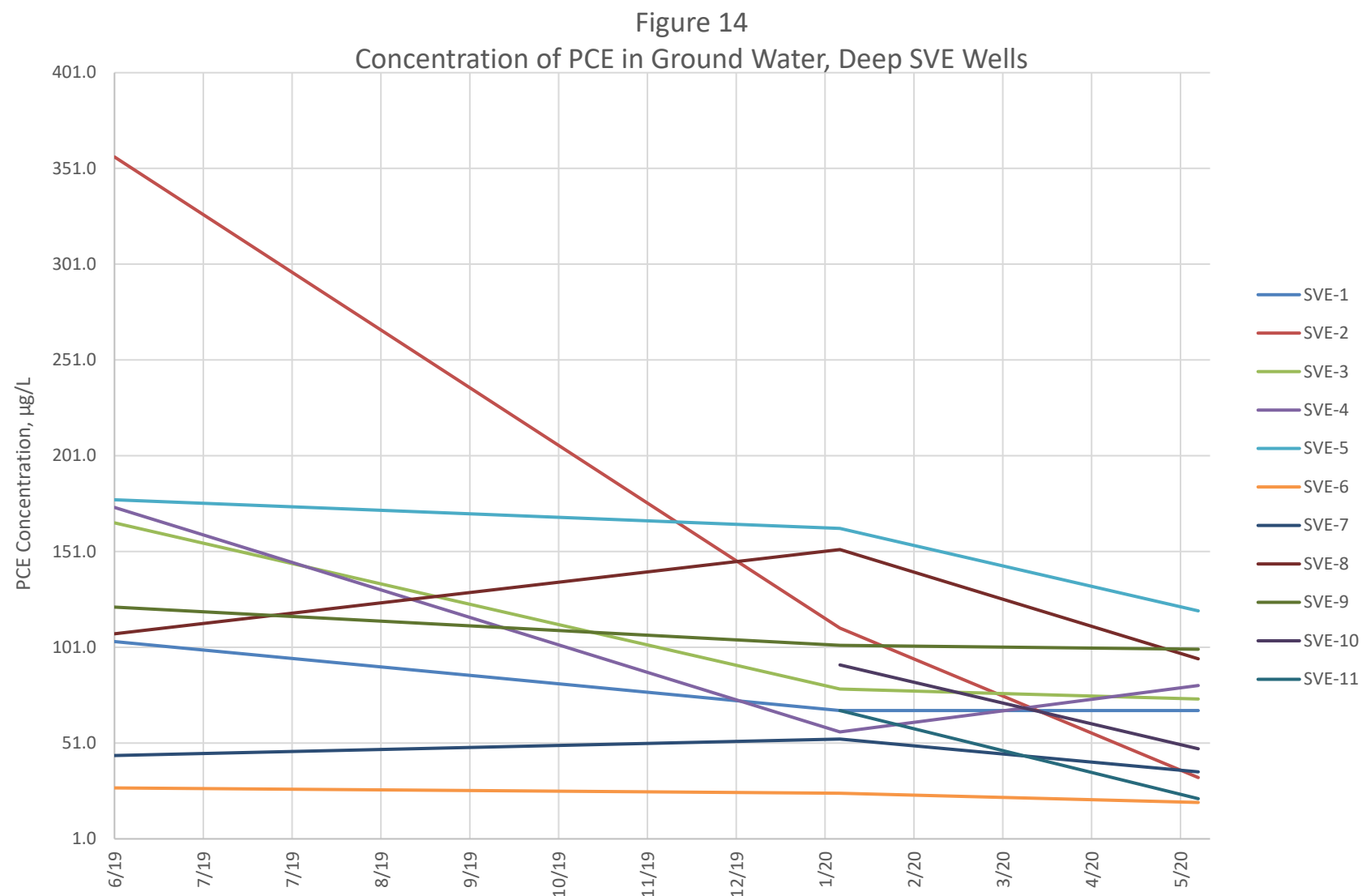


Figure 13





TABLES

Table 1
SVE System Readings

Date	SVE Deep System				SVE Shallow System				
	Blower Influent		Effluent	Blower Hours	LRP Influent		Effluent	LRP Hours	MS Total Flow (Gal)
	Vacuum (in. WC)	Flow (scfm)	Temperature (°F)		Vacuum (in. Hg)	Flow (scfm)	Temperature (°F)		
7/29/19	-	-	-	-	-	-	-	-	-
8/2/19	-	-	-	-	-	-	-	-	-
8/6/19	51.1	268	165	273	-	-	-	161	-
8/13/19	39.7	305	166	395	-	-	-	161	-
8/20/19	41.4	306	153	562	-	-	-	161	-
8/23/19	41.5	305	149	634	26.7	15.8	120	189	-
8/30/19	44.2	291	154	809	-	-	-	258	-
9/6/19	45.2	293	152	989	-	-	-	261	-
9/13/19	48.8	284	170	1,164	-	-	-	261	-
9/20/19	50.9	281	156	1,332	25.2	33.4	124	306	-
9/27/19	49.6	275	159	1,499	-	-	-	306	-
10/4/19	50.8	274	162	1,667	-	-	-	310	-
10/11/19	56.1	276	139	1,834	24.6	40.5	126	373	1,375
10/18/19	51.3	274	147	2,002	22.4	62.5	124	520	1,425
10/25/19	55.7	275	136	2,170	25.1	35.4	119	601	1,645
10/30/19	57.3	271	135	2,289	25.0	36.2	121	716	1,725
11/7/19	56.9	269	145	1,775	25.3	35.1	121	314	1,875
11/15/19	57.8	274	137	1,942	25.7	30.2	116	460	1,985
11/23/19	59.3	263	142	2,110	25.3	34.2	118	541	2,035
11/25/19	54.7	274	149	2,277	25.0	37.0	123	704	2,055
12/2/19	64.3	258	148	2,445	25.6	30.9	117	872	2,275
12/9/19	56.2	263	155	2,604	25.0	36.9	124	1,007	2,545
12/16/19	60.0	256	144	2,771	25.7	30.0	120	1,114	3,545
12/23/19	64.8	239	151	2,939	23.5	53.8	123	1,252	4,385
12/30/19	66.8	248	144	3,107	25.6	32.2	116	1,407	4,855
1/6/20	64.3	232	158	3,274	25.4	34.5	122	1,572	5,535
1/13/20	66.0	227	163	3,442	-	-	-	1,734	5,955
1/20/20	41.5	319	123	3,609	24.1	44.2	104	1,899	6,355
1/27/20	-	-	-	3,777	-	-	-	2,062	6,815
2/3/20	41.5	335	104	3,945	23.1	54.5	99	2,226	6,845
2/12/20	44.7	328	111	4,111	23.4	52.8	101	2,334	7,065
2/21/20	44.8	321	115	4,254	23.4	53.3	103	2,477	7,135
2/26/20	51.0	324	101	4,324	23.5	54.2	98	2,547	7,635
3/4/20	43.9	314	122	4,442	23.3	53.9	106	2,665	7,655
3/11/20	43.1	320	136	4,610	23.2	55.4	111	2,833	7,655
3/18/20	42.4	306	140	4,778	25.7	31.7	104	3,001	7,675
3/25/20	42.0	308	146	4,946	23.4	53.1	114	3,168	9,205
4/1/20	43.6	317	131	5,113	23.3	53.4	109	3,336	9,205
4/8/20	42.3	304	145	5,281	24.2	44.5	111	3,504	10,125
4/15/20	43.9	299	137	5,449	24.2	44.8	110	3,672	10,675
4/22/20	42.1	302	150	5,627	-	-	-	3,850	10,705
4/30/20	43.3	310	149	5,795	24.4	42.3	118	4,017	11,295
5/5/20	42.4	303	158	5,962	24.0	46.5	133	4,185	12,075
5/12/20	42.1	305	149	6,111	24.9	37.6	128	4,305	14,145
5/20/20	-	-	-	6,248	-	-	-	4,305	16,285
5/27/20	42.7	302	150	6,393	25.1	33.7	126	4,415	18,005
6/3/20	44.5	304	141	6,561	26.6	19.6	120	4,583	19,215

Table 1
SVE System Readings

Date	SVE Deep System				SVE Shallow System				
	Blower Influent		Effluent	Blower Hours	LRP Influent		Effluent	LRP Hours	MS Total Flow (Gal)
	Vacuum (in. WC)	Flow (scfm)	Temperature (°F)		Vacuum (in. Hg)	Flow (scfm)	Temperature (°F)		
6/10/20	41.7	306	163	6,727	24.5	38.4	130	4,749	19,545
6/18/20	44.4	308	145	6,865	-	-	-	4,887	18,935
6/25/20	33.2	336	136	7,033	-	-	-	5,055	19,545
7/2/20	32.7	336	143	7,193	-	-	-	5,215	19,545
7/9/20	32.9	334	143	7,278	-	-	-	5,300	19,545
7/16/20	33.7	331	143	7,372	23.2	53.6	129	5,394	19,935
7/22/20	34.1	336	139	7,540	25.2	32.6	122	5,420	26,465
7/29/20	-	-	-	7,707	-	-	-	5,420	26,465
7/31/20	-	-	-	7,980	26.9	16.2	119	6,640	26,465
Minimum	32.7	227	101	N/A	22.4	15.8	98	N/A	N/A
Average	47.8	294	144	N/A	24.6	40.4	117	N/A	N/A
Maximum	66.8	336	170	N/A	26.9	62.5	133	N/A	N/A
NOTES: Dashes (-) indicate the treatment system was not operating at the time of the reading Shaded cells indicate an instrument recording error °F = Degrees Fahrenheit. in. Hg = inches of mercury in. WC = inches of water column GAC = granular activated carbon. Gal = gallon(s). MS = moisture separator scfm = standard cubic feet per minute SVE = Soil Vapor Extraction									

Table 2
Deep SVE System Analytical Sampling Results

Sample ID	Sample Date	PCE	TCE	1,1-DCE	cis-1,2-DCE	trans-1,2 DCE	Vinyl Chloride
Pre-GAC	7/30/2019	61,000	2,300	16	2,600	20	52
Pre-GAC	8/7/2019	97,000	3,200	23	2,900	41	300
Pre-GAC	8/28/2019	31,000	1,050	8	810	9	22
Pre-GAC	9/18/2019	35,000	1,200	10	890	12	15
Pre-GAC	10/10/2019	27,000	870	BRL	480	BRL	BRL
Pre-GAC	10/24/2019	28,000	940	7	780	8	14
Pre-GAC	12/4/2019	17,000	520	BRL	380	BRL	BRL
Pre-GAC	12/16/2019	1,400	20	BRL	BRL	BRL	BRL
Pre-GAC	12/30/2019	8,800	380	4	350	BRL	BRL
Pre-GAC	1/14/2020	11,000	510	4	520	BRL	BRL
Pre-GAC	2/12/2020	2,900	120	BRL	125	BRL	BRL
Pre-GAC	3/18/2020	2,000	92	BRL	120	BRL	BRL
Pre-GAC	4/30/2020	1,300	52	BRL	87	BRL	BRL
Pre-GAC	5/20/2020	525	27	BRL	43	BRL	BRL
Pre-GAC	6/24/2020	190	10	BRL	14	BRL	BRL
Pre-GAC	7/22/2020	6	BRL	BRL	BRL	BRL	BRL
Mid-GAC	7/30/2019	25	BRL	BRL	BRL	BRL	42
Mid-GAC	8/7/2019	3	BRL	14	BRL	BRL	320
Mid-GAC	8/28/2019	BRL	BRL	9	1,500	19	13
Mid-GAC	9/18/2019	BRL	14	6	790	8	14
Mid-GAC	10/10/2019	23,500	1,950	9	840	10	14
Mid-GAC	10/24/2019	20,000	980	6	570	8	11
Mid-GAC	12/4/2019	BRL	BRL	BRL	BRL	BRL	BRL
Mid-GAC	12/16/2019	BRL	BRL	BRL	BRL	BRL	BRL
Mid-GAC	12/30/2019	BRL	BRL	6	10	BRL	5
Mid-GAC	1/14/2020	220	10	10	520	9	BRL
Mid-GAC	2/12/2020	160	BRL	BRL	170	BRL	BRL
Mid-GAC	3/18/2020	210	BRL	BRL	570	BRL	BRL
Mid-GAC	4/30/2020	170	BRL	BRL	BRL	BRL	BRL
Mid-GAC	5/20/2020	0	BRL	BRL	BRL	BRL	BRL
Mid-GAC	6/24/20	0	BRL	BRL	55	BRL	BRL
Mid-GAC	7/22/20	BRL	BRL	BRL	23	BRL	BRL
Post-GAC	7/30/19	7	BRL	BRL	BRL	BRL	44
Post-GAC	8/7/19	2	BRL	BRL	BRL	BRL	90
Post-GAC	8/28/19	4	BRL	3	BRL	BRL	13
Post-GAC	9/18/19	BRL	BRL	7	900	14	13
Post-GAC	10/10/19	41	BRL	BRL	1,700	BRL	16
Post-GAC	10/24/19	27	BRL	BRL	420	BRL	6
Post-GAC	12/4/19	BRL	BRL	BRL	BRL	BRL	BRL
Post-GAC	12/16/19	BRL	BRL	BRL	BRL	BRL	BRL
Post-GAC	12/30/19	BRL	BRL	BRL	BRL	BRL	BRL
Post-GAC	1/14/20	120	BRL	BRL	BRL	BRL	7
Post-GAC	2/12/20	110	BRL	BRL	BRL	BRL	BRL
Post-GAC	3/18/20	160	BRL	BRL	BRL	BRL	BRL
Post-GAC	4/30/20	130	BRL	BRL	BRL	BRL	BRL
Post-GAC	5/20/20	BRL	BRL	BRL	BRL	BRL	BRL
Post-GAC	6/24/20	BRL	BRL	BRL	BRL	BRL	BRL
Post-GAC	7/22/20	BRL	BRL	BRL	BRL	BRL	BRL

NOTES:Concentrations are reported in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$).

BRL = Below Reporting Limit

DCE = Dichloroethene.

GAC = Granular Activated Carbon.

PCE = Tetrachloroethene.

TCE = Trichloroethene.

Table 3
Deep SVE System Analytical Sampling Results Summary

Date	PCE Concentration			TCE Concentration		
	Pre-GAC	Mid-GAC	Post-GAC	Pre-GAC	Mid-GAC	Post-GAC
7/30/19	61,000	25	7	2,300	BRL	BRL
8/7/19	97,000	3	2	3,200	BRL	BRL
8/28/19	31,000	BRL	4	1,050	BRL	BRL
9/18/19	35,000	BRL	BRL	1,200	14	BRL
10/10/19	27,000	23,500	41	870	1,950	BRL
10/24/19	28,000	20,000	27	940	980	BRL
12/4/19	17,000	BRL	BRL	520	BRL	BRL
12/16/19	1,400	BRL	BRL	20	BRL	BRL
12/30/19	8,800	BRL	BRL	380	BRL	BRL
1/14/20	11,000	220	120	510	10	BRL
2/12/20	2,900	160	110	120	BRL	BRL
3/18/20	2,000	210	160	92	BRL	BRL
4/30/20	1,300	170	130	52	BRL	BRL
5/20/20	525	BRL	BRL	27	BRL	BRL
6/24/20	190	BRL	BRL	10	BRL	BRL
7/22/20	6	BRL	BRL	BRL	BRL	BRL
NOTES: Concentrations are reported in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). BRL = Below Reporting Limit GAC = Granular Activated Carbon. PCE = Tetrachloroethene. TCE = Trichloroethene.						

Table 4
Deep SVE System Uptime and Mass Removal Summary

Month	Days	Uptime (days)	Uptime (%)	Avg. Flow (SCFM)	Volume of Air Extracted (m ³)	Sample Date(s)*	PCE Conc. (µg/m ³)	Monthly PCE Removed (g)	Cum. PCE Removed (g)	PCE Removal Rate (lb./hr.)	TCE Conc. (µg/m ³)	Monthly TCE Removed (g)	Cum. TCE Removed (g)	TCE Removal Rate (lb./hr.)
8/19	28	26	93%	290	307,500	7/30,8/7,8/28	62,667	19,267	19,267	0.06807	2,167	666	666	0.00235
9/19	28	28	100%	250	285,400	9/18	35,000	9,990	29,257	0.03277	1,200	343	1,009	0.00112
10/19	35	35	100%	280	399,600	10/10	27,000	10,789	40,047	0.02832	870	348	1,356	0.00091
11/19	28	27.5	98%	280	302,800	10/24	28,000	8,477	48,524	0.02832	940	285	1,641	0.00095
12/19	35	32	91%	250	326,200	12/4,12/16	9,200	3,001	51,525	0.00862	270	88	1,729	0.00025
1/20	28	24.8	89%	240	242,700	12/30,1/14	59,400	14,416	65,941	0.05340	445	108	1,837	0.00040
2/20	28	28	100%	325	371,100	2/12	2,900	1,076	67,018	0.00353	120	45	1,882	0.00015
3/20	28	28	100%	320	365,400	3/19	2,000	731	67,748	0.00240	92	34	1,915	0.00011
4/20	35	27.5	79%	310	353,900	4/30	1,300	460	68,208	0.00154	52	18	1,934	0.00006
5/20	28	26	93%	305	323,400	5/20	525	170	68,378	0.00060	27	9	1,942	0.00003
6/20	28	21	75%	305	261,200	6/24	190	50	68,428	0.00022	10	3	1,945	0.00001
7/20	35	21.4	61%	333	290,600	7/22	6	2	68,429	0.00001	0	0	1,945	0.00000

NOTES:

*Sample Date is the sample collection date that PCE and TCE concentrations (Table 3) were used to extrapolate mass removal calculations. If multiple dates are listed, the arithmetic average of concentrations from those samples was used.

µg = micrograms

conc. = concentration

cum. = cumulative

g = grams

hr. = hour

lb. = pound

m³ = cubic meters

PCE = Tetrachloroethene.

SCFM = Standard cubic feet per minute

TCE = Trichloroethene.

Table 5
Deep SVE Well Analytical Sampling Results

Date	Contaminant	SVE-1	SVE-2	SVE-3	SVE-4	SVE-5	SVE-6	SVE-7	SVE-9	SVE-10	SVE-11
7/30/19	PCE	52,000	65,000	12,000	51,000	11,000	27,500	11,000	23,000	8,500	4,900
1/14/20		45,000	44,000	4,300	240	4,200	760	400	11,000	150	320
Decrease		13%	32%	64%	100%	62%	97%	96%	52%	98%	93%
7/30/19	TCE	1,400	2,500	170	1,900	340	815	320	1,100	390	230
1/14/20		1,200	2,800	97	J 12	310	34	28	840	J 10	J 18
Decrease		14%	-12%	43%	99%	9%	96%	91%	24%	97%	92%

NOTES:
Concentrations are reported in micrograms per cubic meter (µg/m³).
J = Analysis result is estimated
PCE = Tetrachloroethene
SVE = Soil vapor extraction.
TCE = Trichloroethene

Table 6
Shallow SVE System Analytical Sampling Results

Sample ID	Sample Date	PCE	TCE	1,1-DCE	cis-1,2-DCE	trans-1,2 DCE	Vinyl Chloride
Pre-GAC	7/30/2019	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled	Cancelled
Pre-GAC	8/28/2019	730,000	43,000	220	55,000	1,200	16,000
Pre-GAC	9/18/2019	38,000	15,500	295	42,000	1,350	20,500
Pre-GAC	10/10/2019	970,000	50,000	220	86,000	1,700	15,000
Pre-GAC	10/24/2019	160,000	7,300	25	7,300	240	1,600
Pre-GAC	12/4/2019	180,000	6,700	19	9,700	210	1,600
Pre-GAC	12/16/2019	200,000	8,800	27	18,000	190	2,000
Pre-GAC	12/30/2019	320,000	13,500	46	24,500	230	2,100
Pre-GAC	1/14/2020	235,000	28,500	27	21,000	195	670
Pre-GAC	2/12/2020	42,000	1,500	8	2,500	49	490
Pre-GAC	3/19/2020	120,000	5,700	21	12,000	110	980
Pre-GAC	4/30/2020	21,000	640	3	1,200	23	240
Pre-GAC	5/20/2020	90,000	3,800	17	7,600	82	800
Pre-GAC	6/24/2020	130,000	3,000	10	6,200	58	510
Pre-GAC	7/22/2020	330,000	10,000	35	18,000	130	1,300
Mid-GAC	7/30/2019	130	BRL	BRL	BRL	BRL	5,400
Mid-GAC	8/28/2019	BRL	1,700	160	42,000	490	14,000
Mid-GAC	9/18/2019	21	690	19	14,000	140	4,000
Mid-GAC	10/10/2019	15,000	24,000	250	85,000	1,600	16,000
Mid-GAC	10/24/2019	81,000	7,200	30	7,300	180	2,000
Mid-GAC	12/4/2019	180	12	BRL	100	BRL	1,800
Mid-GAC	12/16/2019	95	26	BRL	150	BRL	BRL
Mid-GAC	12/30/2019	19,000	3,500	36	11,000	140	2,000
Mid-GAC	1/14/2020	120,000	3,800	BRL	6,000	BRL	290
Mid-GAC	2/12/2020	6,200	820	20	3,900	48	480
Mid-GAC	3/18/2020	76,000	21,000	33	30,000	340	1,200
Mid-GAC	4/30/2020	510	BRL	BRL	BRL	BRL	47
Mid-GAC	5/20/2020	1,100	510	40	8,000	74	610
Mid-GAC	6/24/2020	47,000	1,800	6	3,300	32	320
Mid-GAC	7/22/2020	110,000	10,000	39	31,000	240	1,600
Post-GAC	7/30/2019	BRL	BRL	BRL	BRL	BRL	5,100
Post-GAC	8/28/2019	BRL	BRL	BRL	BRL	BRL	11,000
Post-GAC	9/18/2019	BRL	BRL	10	7	BRL	1,200
Post-GAC	10/10/2019	BRL	BRL	120	670	BRL	18,000
Post-GAC	10/24/2019	2,100	2,000	47	21,000	360	2,000
Post-GAC	12/4/2019	160	BRL	BRL	14	BRL	2,200
Post-GAC	12/16/2019	29	17	39	1,200	37	2,000
Post-GAC	12/30/2019	130	220	37	6,700	100	2,200
Post-GAC	1/14/2020	8,900	5,400	54	27,000	270	980
Post-GAC	2/12/2020	4,000	1,200	18	4,000	45	460
Post-GAC	3/18/2020	3,700	1,300	50	8,600	99	1,100

Table 6
Shallow SVE System Analytical Sampling Results

Sample ID	Sample Date	PCE	TCE	1,1-DCE	cis-1,2-DCE	trans-1,2 DCE	Vinyl Chloride
Post-GAC	4/30/2020	230	9	BRL	11	BRL	BRL
Post-GAC	5/20/2020	97	41	29	700	13	690
Post-GAC	6/24/2020	2,900	600	11	5,700	45	460
Post-GAC	7/22/2020	39,000	4,800	37	18,000	170	1,500

NOTES:

Concentrations are reported in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$).

BRL = Below Reporting Limit

DCE = Dichloroethene.

GAC = Granular Activated Carbon.

PCE = Tetrachloroethene.

TCE = Trichloroethene.

Table 7
Shallow SVE System Analytical Sampling Summary

Date	PCE Concentration			TCE Concentration		
	Pre-GAC	Mid-GAC	Post-GAC	Pre-GAC	Mid-GAC	Post-GAC
7/30/19	Cancelled	130	BRL	Cancelled	BRL	BRL
8/28/19	730,000	BRL	BRL	43,000	1,700	BRL
9/18/19	38,000	21	BRL	15,000	690	BRL
10/10/19	970,000	15,000	BRL	50,000	24,000	BRL
10/24/19	160,000	81,000	2,100	7,300	7,200	2,000
12/4/19	180,000	180	160	6,700	12	BRL
12/16/19	200,000	95	29	8,800	26	17
12/30/19	320,000	19,000	130	13,500	3,500	220
1/14/20	235,000	120,000	8,900	28,500	3,800	5,400
2/12/20	42,000	6,200	4,000	1,500	820	1,200
3/19/20	120,000	76,000	3,700	5,700	21,000	1,300
4/30/20	21,000	510	230	640	6	9
5/20/20	90,000	1,100	97	3,800	510	41
6/24/20	130,000	47,000	2,900	3,000	1,800	600
7/22/20	330,000	110,000	39,000	10,000	10,000	4,800
NOTES: Concentrations are reported in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). BRL = Below Reporting Limit GAC = Granular Activated Carbon. PCE = Tetrachloroethene. TCE = Trichloroethene.						

Table 8
Shallow SVE System Uptime and Mass Removal Summary

Month	Days	Uptime (days)	Uptime (%)	Avg. Flow (SCFM)	Volume of Air Extracted (m ³)	Sample Date(s)*	PCE Conc. (µg/m ³)	Monthly PCE Removed (g)	Cum. PCE Removed (g)	PCE Removal Rate (lb./hr.)	TCE Conc. (µg/m ³)	Monthly TCE Removed (g)	Cum. TCE Removed (g)	TCE Removal Rate (lb./hr.)
8/19	28	5	18%	11	2,243	8/28	730,000	1,637	1,637	0.0301	43,000	96	96	0.0018
9/19	28	2	7%	14	1,142	9/18	38,000	44	1,681	0.0020	15,500	18	115	0.0008
10/19	35	18	51%	20	14,679	10/10	970,000	14,076	15,757	0.0718	50,000	741	856	0.0038
11/19	28	23	82%	20	29,073	10/24	160,000	4,779	20,536	0.0191	7,300	221	1,077	0.0009
12/19	35	31.0	89%	35	44,311	12/4,12/16	190,000	8,650	29,186	0.0256	7,750	337	1,413	0.0010
1/20	28	22	79%	38	34,089	12/30,1/14	277,500	9,690	38,875	0.0405	21,000	731	2,144	0.0031
2/20	28	28	100%	55	62,795	2/12	42,000	2,637	41,513	0.0087	1,500	94	2,239	0.0003
3/20	28	28	100%	30	34,252	3/19	120,000	4,110	45,623	0.0135	5,700	195	2,434	0.0006
4/20	35	35	100%	50	59,125	4/30	21,000	1,242	46,865	0.0033	640	38	2,472	0.0001
5/20	28	26	93%	38	40,287	5/20	90,000	3,626	50,491	0.0128	3,800	153	2,625	0.0005
6/20	28	18.5	66%	36	27,157	6/24	130,000	3,530	54,021	0.0175	3,000	81	2,706	0.0004
7/20	35	18.8	54%	33	24,953	7/22	330,000	8,234	62,255	0.0402	10,000	250	2,956	0.0012

NOTES:

*Sample Date is the sample collection date that was used to extrapolate mass removal calculations. If multiple dates are listed, the arithmetic average of concentrations from those samples was used.

µg = micrograms

conc. = concentration

cum. = cumulative

g = grams

hr. = hour

lb. = pound

m³ = cubic meters

PCE = Tetrachloroethene.

SCFM = Standard cubic feet per minute

TCE = Trichloroethene.

Table 9
Shallow SVE Well Analytical Sampling Results

Date	Contaminant	SSVE-4	SSVE-5	SSVE-6	SSVE-7	SSVE-8	SSVE-9	SSVE-10	SSVE-11	SSVE-12	SSVE-13	SSVE-14
7/30/19	PCE	200,000	1,700,000	160	2,100,000	7,100	56,000	17,000	130,000	9,200	10,000	5,100
1/14/20		360,000	34,000	1,100	1,000,000	1,500	46,000	1,200,000	64,000	7,700	16,000	1,200
Decrease		-80%	98%	-588%	52%	79%	18%	-6959%	51%	16%	-60%	76%
7/30/19	TCE	6,100	9,600	U 8	120,000	310	4,700	640	19,000	1,200	300	290
1/14/20		2,700	410	58	34,000	140	2,800	120,000	17,000	430	4,200	39
Decrease		56%	96%	-625%	72%	55%	40%	-18650%	11%	64%	-1300%	87%
NOTES: Concentrations are reported in micrograms per cubic meter (µg/m³). U = Analysis result below the method detection limit PCE = Tetrachloroethene SVE = Soil vapor extraction. TCE = Trichloroethene												

Table 10
Deep SVE System Photoionization Detector Readings

Date	Treatment System			Wellheads									
	Pre-GAC	Mid-GAC	Post-GAC	SVE-1	SVE-2	SVE-3	SVE-4	SVE-5	SVE-6	SVE-7	SVE-9	SVE-10	SVE-11
5/12/20	47.2	11.1	7.8	80.2	67.1	43.8	60.1	36.2	51.2	18.2	82.1	51.9	77.2
5/20/20	4.3	0.4	0.0	49.5	64.3	24.9	68.3	3.5	14.8	16.9	46.8	43.8	168
6/10/20	0.1	0.0	0.0	12.1	27.1	23.4	19	2.5	1.1	4.9	23.2	8.2	11.9
7/22/20	12.9	15.3	16.6	3.5	5.0	2.1	3.5	0.9	0.3	0.4	2.9	1.4	14
NOTES: Reading are for total volatile organic compounds and recorded in ppmv. GAC = Granular activated carbon. ppmv = Parts per million by volume. SVE = Soil vapor extraction.													

Table 11
Shallow SVE System Photoionization Detector Readings

Date	Treatment System			Wellheads										
	Pre-GAC	Mid-GAC	Post-GAC	SSVE-4	SSVE-5	SSVE-6	SSVE-7	SSVE-8	SSVE-9	SSVE-10	SSVE-11	SSVE-12	SSVE-13	SSVE-14
5/12/20	70.2	55.6	75.6	37.5	54.9	65.4	62.6	28.6	12.8	168	9.4	6.3	2.2	24
5/20/20	47.1	17.1	11.0	32.8	20.2	81.4	28.1	15.2	7.8	3.5	1.4	19.4	1	17.9
6/10/20	33.5	23.9	24.2	1.8	6.2	10.8	13.7	12.1	6.7	4.8	0.8	21.3	3	32.8
7/22/20	82.8	143.0	17.7	27.7	14.2	28.9	28.8	2.7	4.7	6.5	1.3	4.8	1.8	2.8

NOTES:

Reading are for total volatile organic compounds and recorded in ppmv.

GAC = Granular activated carbon.

ppmv = Parts per million by volume.

SVE = Soil vapor extraction.

Table 12
Water Treatment System Sampling Results

Sample ID	Sample Date	PCE	TCE	1,1-DCE	cis-1,2-DCE	trans-1,2 DCE	Vinyl Chloride
Pre-GAC	7/30/2019	356.5	27.2	BRL	84.3	BRL	2.3
Pre-GAC	8/1/2019	237.0	24.7	BRL	79.3	BRL	BRL
Pre-GAC	8/27/2019	432.0	47.7	BRL	186.0	2.0	6.7
Pre-GAC	12/16/2019	160.0	13.1	BRL	56.7	BRL	BRL
Pre-GAC	1/29/2020	46.7	3.2	BRL	12.1	BRL	BRL
Pre-GAC	3/23/2020	37.4	4.5	BRL	34.4	BRL	BRL
Pre-GAC	4/20/2020	27.2	1.5	BRL	6.4	BRL	BRL
Pre-GAC	7/22/2020	58.8	4.0	BRL	18.4	BRL	BRL
Mid-GAC	7/30/2019	237.0	19.9	BRL	59.6	BRL	BRL
Mid-GAC	8/1/2019	238.0	22.1	BRL	78.6	BRL	BRL
Mid-GAC	8/27/2019	402.0	48.4	BRL	183.0	1.9	7.1
Mid-GAC	12/16/2019	72.5	7.2	BRL	31.4	BRL	BRL
Mid-GAC	1/29/2020	61.8	3.6	BRL	12.2	BRL	BRL
Mid-GAC	4/20/2020	25.7	1.5	BRL	6.8	BRL	BRL
Mid-GAC	7/22/2020	58.8	4.2	BRL	18.4	BRL	BRL
Post-GAC	7/30/2019	146.0	16.0	BRL	37.8	BRL	BRL
Post-GAC	8/1/2019	155.5	14.6	BRL	48.4	BRL	BRL
Post-GAC	8/13/2019	44.6	3.6	BRL	11.6	BRL	BRL
Post-GAC	8/20/2019	44.4	3.7	BRL	11.3	BRL	BRL
Post-GAC	8/27/2019	406.5	47.2	BRL	183.0	1.8	7.3
Post-GAC	12/16/2019	97.8	9.4	BRL	39.6	BRL	BRL
Post-GAC	1/29/2020	42.1	3.4	BRL	11.7	BRL	BRL
Post-GAC	3/23/2020	65.1	6.8	BRL	47.1	BRL	BRL
Post-GAC	4/20/2020	25.3	1.3	BRL	5.9	BRL	BRL
Post-GAC	7/22/2020	48.9	3.8	BRL	18.4	BRL	BRL
Storage Tank	8/1/2019	119.0	10.6	BRL	36.4	BRL	BRL
Storage Tank	8/7/2019	29.7	2.7	BRL	10.5	BRL	BRL
Storage Tank	8/9/2019	34.8	3.4	BRL	14.0	BRL	BRL
Storage Tank	8/13/2019	3.6	BRL	BRL	2.4	BRL	BRL
Storage Tank	8/20/2019	BRL	BRL	BRL	BRL	BRL	BRL
Storage Tank	8/27/2019	9.9	2.0	BRL	13.9	BRL	BRL
Storage Tank	10/24/2019	BRL	BRL	BRL	BRL	BRL	BRL
Storage Tank	12/16/2019	13.0	1.5	BRL	9.0	BRL	BRL
Storage Tank	12/30/2019	27.1	3.4	BRL	32.7	BRL	BRL
Storage Tank	1/15/2020	11.9	1.8	BRL	21.5	BRL	BRL
Storage Tank	1/29/2020	1.7	BRL	BRL	BRL	BRL	BRL
Storage Tank	3/23/2020	BRL	BRL	BRL	3.0	BRL	BRL
Storage Tank	4/20/2020	BRL	BRL	BRL	BRL	BRL	BRL
Storage Tank	7/22/2020	1.3	BRL	BRL	BRL	BRL	BRL

NOTES:

Concentrations are reported in micrograms per liter (µg/L).

BRL = Below Reporting Limit

DCE = Dichloroethene.

GAC = Granular Activated Carbon.

PCE = Tetrachloroethene.

TCE = Trichloroethene.

Table 13
Summary of Water Treatment System Analytical Sampling

Date	PCE Concentration				TCE Concentration			
	Pre-GAC	Mid-GAC	Post-GAC	Tank	Pre-GAC	Mid-GAC	Post-GAC	Tank
7/30/19	356.5	237.0	146.0	N/S	27.2	19.9	16.0	N/S
8/1/19	237.0	238.0	155.5	119.0	24.7	22.1	14.6	10.6
8/7/19	N/S	N/S	N/S	29.7	N/S	N/S	N/S	2.7
8/9/19	N/S	N/S	N/S	34.8	N/S	N/S	N/S	3.4
8/13/19	N/S	N/S	44.6	3.6	N/S	N/S	3.6	BRL
8/20/19	N/S	N/S	44.4	BRL	N/S	N/S	3.7	BRL
8/27/19	239.5	129.0	162.0	1.9	22.2	18.2	16.7	BRL
10/10/19	432.0	402.0	406.5	9.9	47.7	48.4	47.2	2.0
10/24/19	N/S	N/S	N/S	BRL	N/S	N/S	N/S	BRL
12/16/19	160.0	72.5	97.8	13.0	13.1	7.2	9.4	1.5
12/30/19	N/S	N/S	N/S	27.1	N/S	N/S	N/S	3.4
1/15/20	N/S	N/S	N/S	11.9	N/S	N/S	N/S	1.8
1/29/20	46.7	61.8	42.1	1.7	3.2	3.6	3.4	BRL
3/23/20	37.4		65.1	BRL	4.5		6.8	BRL
4/21/20	27.2	25.7	25.3	BRL	1.5	BRL	BRL	BRL
7/22/20	58.8	58.8	48.9	1.3	4.0	4.2	3.8	BRL
NOTES: Concentrations are reported in micrograms per liter (µg/L). BRL = Below Reporting Limit GAC = Granular Activated Carbon. N/S = Not Sampled. PCE = Tetrachloroethene. TCE = Trichloroethene.								

Table 14
Summary of Ground Water Analytical Sampling

Well	Zone	PCE Concentration				
		Jun-19	Feb-20	% Decrease Jun. '19 - Feb. '20	Jun-20	% Decrease Jun. '19 - Jun. '20
SVE-1	Deep	104.0	68.0	35%	68.0	35%
SVE-2	Deep	357.0	111.0	69%	33.0	91%
SVE-3	Deep	166.0	79.2	52%	74.0	55%
SVE-4	Deep	174.0	56.8	67%	81.0	53%
SVE-5	Deep	178.0	163.0	8%	120.0	33%
SVE-6	Deep	27.6	24.8	10%	20.0	28%
SVE-7	Deep	44.5	53.1	-19%	36.0	19%
SVE-8	Deep	108.0	152.0	-41%	95.0	12%
SVE-9	Deep	122.0	102.0	16%	100.0	18%
SVE-10	Deep	N/S	91.8	--	48.0	--
SVE-11	Deep	N/S	68.0	--	22.0	--
Average	Deep	142.3	88.2	22%	63.4	38%
MW-01	Shallow	N/S	BRL	--	BRL	--
MW-02	Shallow	N/S	30.0	--	N/S	--
MW-03	Shallow	N/S	7.7	--	2.5	68%
MW-04	Shallow	N/S	BRL	--	N/S	--
MW-05	Shallow	N/S	BRL	--	BRL	--
MW-06	Shallow	N/S	BRL	--	N/S	--
MW-07	Shallow	N/S	BRL	--	BRL	--
MW-08	Shallow	N/S	BRL	--	N/S	--
MW-09	Shallow	N/S	BRL	--	BRL	--
MW-20	Shallow	N/S	8,600	--	8,900	-3%
MW-21	Shallow	N/S	BRL	--	N/S	--
Average	Shallow	--	785	--	1,483.8	32%
NOTES:						
Concentrations are reported in micrograms per liter (µg/L).						
BRL = Below Reporting Limit						
N/S = Not Sampled.						
PCE = Tetrachloroethene.						

APPENDIX A

System Readings Datasheets

(Provided in Electronic Format via Compact Disc)

APPENDIX B

Field Logbook

(Provided in Electronic Format via Compact Disc)

APPENDIX C

Air Sampling Analytical Reports

(Provided in Electronic Format via Compact Disc)

APPENDIX D

Water Sampling Analytical Reports

(Provided in Electronic Format via Compact Disc)